Test report

REP058476-3R1TRFWL

Date of issue: October 10, 2024

Applicant:

Miridia Technology Inc.

Product description:

Acupuncture Point Locator

Model:

AccuCore M1

Product marketing name(s):

None

FCC ID:

2BLG7-M1A-BDR-529

Specifications:

- FCC 47 CFR Part 15, Subpart C – §15.247
  Operation within the bands 902 – 928 MHz, 2400 – 2483.5 MHz, 5727 – 5850 MHz

Lab and test locations

Company name	Nemko USA Inc.
Address	2210 Faraday Ave, Suite 150
City	Carlsbad
State	California
Postal code	92008
Country	USA
Telephone	+1 760 444 3500
Website	www.nemko.com
FCC Site Number	Test Firm Registration Number: 392943; Designation Number: US5058
ISED Test Site	2040B-3

Tested by	Lan Sayasane, EMC Test Engineer
Reviewed by	James Cunningham, EMC/WL Manager
Review date	October 10, 2024
Reviewer signature	

Limits of responsibility

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.
This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contain in this report are within Nemko USA's ISO/IEC 17025 accreditation.
This report must not be used by the client to claim product certification, approval, or endorsement by ANAB, NIST, or any agency of the U.S. Government.

Copyright notification

Table of Contents

Section 1 Report summary

1.1 Test specifications

FCC 47 CFR Part 15, Subpart C – §15.247	Operation within the bands 902 – 928 MHz, 2400 – 2483.5 MHz, 5727 – 5850 MHz

1.2 Exclusions

None.

1.3 Statement of compliance

Testing was performed against all relevant requirements of the test standard(s).

Results obtained indicate that the product under test complies in full with the tested requirements.

The test results relate only to the item(s) tested.

See “Section 2 Summary of test results” for full details.

1.4 Test report revision history

Table 1.4-1: *Test report revision history*

Revision #	Issue Date	Details of changes made to test report
REP058476-3TRFEMC	October 9, 2024	Original report issued
REP058476-3R1TRFEMC	October 10, 2024	Updated following TCB feedback

Section 2 Summary of test results

2.1 Sample information

Receipt date	30-Sep-24
Nemko sample ID number	REP058476

2.2 Testing period

Test start date	30-Sep-24
Test end date	04-Oct-24

2.3 Test results

Table 2.3-1: *FCC 47 CFR Part 15, Subpart B & C, general requirements*

Part	Test description	Verdict
§15.207(a)	Conducted limits	Not applicable [1]
§15.31(e)	Variation of power source	Pass
§15.203	Antenna requirement	Pass

Notes: [1] EUT is DC powered from dedicated DC source or battery powered

Table 2.3-2: *FCC 47 CFR Part 15, Subpart C, §15.247 requirements*

Part	Test description	Verdict
§15.247(a)(1)(i)	Frequency hopping systems operating in the 902–928 MHz band	Not applicable
§15.247(a)(1)(ii)	Frequency hopping systems operating in the 5725–5850 MHz band	Not applicable
§15.247(a)(1)(iii)	Frequency hopping systems operating in the 2400–2483.5 MHz band	Not applicable
§15.247(a)(2)	Minimum 6 dB bandwidth for systems using digital modulation techniques	Pass
§15.247(b)(1)	Maximum peak output power of frequency hopping systems operating in the 2400–2483.5 MHz band and 5725–5850 MHz band	Not applicable
§15.247(b)(2)	Maximum peak output power of Frequency hopping systems operating in the 902–928 MHz band	Not applicable
§15.247(b)(3)	Maximum peak output power of systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands	Pass
§15.247(b)(4)	Transmitting antennas of directional gain greater than 6 dBi	Not applicable
§15.247(c)(1)	Fixed point-to-point operation with directional antenna gains greater than 6 dBi	Not applicable
§15.247(c)(2)	Transmitters operating in the 2400–2483.5 MHz band that emit multiple directional beams	Not applicable
§15.247(d)	Spurious emissions	Pass
§15.247(e)	Power spectral density for digitally modulated devices	Pass
§15.247(f)	Time of occupancy for hybrid systems	Not applicable

Section 3 Equipment under test (EUT) details

3.1 Disclaimer

This section contains information provided by the applicant and has been utilized to support the test plan. Inaccurate information provided by the applicant can affect the validity of the results within this test report. Nemko accepts no responsibility for the information contained within this section and the impact it may have on the test plan and resulting measurements.

3.2 Applicant

Company name	Miridia Technology Inc.
Address	1875 North Lakes Place
City	Meridian
State	ID
Postal/Zip code	83646
Country	USA

3.3 Manufacturer

Company name	Miridia Technology Inc.
Address	1875 North Lakes Place
City	Meridian
State	ID
Postal/Zip code	83646
Country	USA

3.4 EUT information

Product name	Acupuncture Point Locator
Model	AccuCore M1
Variant(s)	None
Serial number	N/A
Part number	N/A
Power requirements	Battery
Description/theory of operation	Acupuncture point locator that uses galvanic skin resistance measurements to locate areas of high conductance. The device is a hand-held probe that communicates with a host device (computer or mobile device) via bluetooth LE.

3.5 Transmitter Information

Frequency band	2400 – 2483.5 MHz
Transmitter type	☐ Frequency hopping spread spectrum (FHSS) ☒ Digital transmission system (DTS) ☐ Hybrid FHSS / DTS
Minimum frequency (MHz)	2402
Maximum frequency (MHz)	2480
Type of modulation	GFSK
Data rate	☐ 125 kbps operation ☐ 500 kbps operation ☒ 1 Mbps operation ☒ 2 Mbps operation
Tested frequencies	2402 MHz (low), 2440 MHz (middle), and 2480 MHz (high)
Antenna part number	AMCA31-2R450G-S1F-T3
Antenna type	Surface Mount (SMD) – WLAN Ceramic Chip Antenna 2450MHz
Antenna peak gain	2.3 dBi

3.6 EUT setup details

Table 3.6-1: *EUT sub assemblies*

Description	Brand name	Model/Part number	Serial number	Rev.
None	N/A	N/A	N/A	N/A

Table 3.6-2: *EUT interface ports*

Description	Qty.
None	N/A

Table 3.6-3: *Support equipment*

Description	Brand name	Model/Part number	Serial number	Rev.
Laptop	Hewlett Packard	15-fd0131/9C9A2UA#ABA	5CD4162CJ9	--

Table 3.6-4: *Inter-connection cables*

Cable description	From	To	Length (m)
None	N/A	N/A	N/A

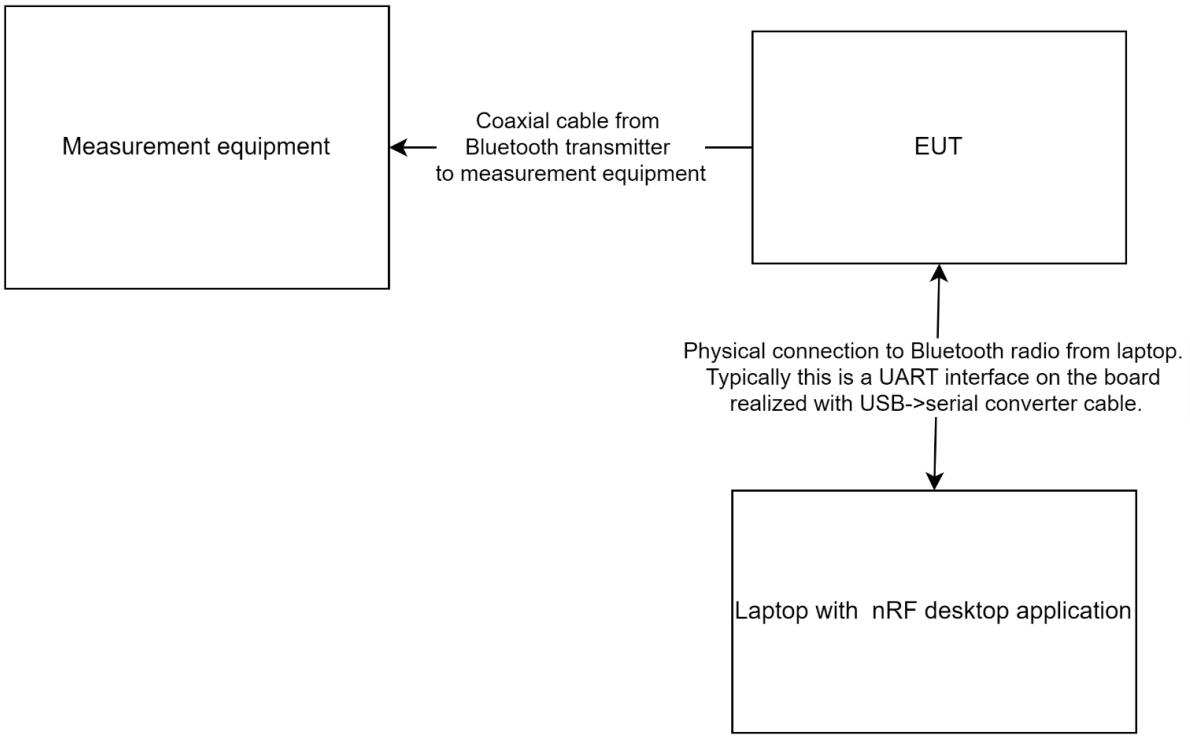

Figure 3.6-1: Test setup diagram

Section 4 Engineering considerations

4.1 Modifications incorporated in the EUT

None.

4.2 Technical judgement

None.

4.3 Deviations from laboratory test procedures

None.

Section 5 Test conditions

5.1 Atmospheric conditions

Temperature	15–30 °C
Relative humidity	20–75 %
Air pressure	86–106 kPa

When it is impracticable to carry out tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests shall be recorded and stated.

5.2 Power supply range

The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage, or any of the declared voltages ±5 %, for which the equipment was designed.

Section 6 Measurement uncertainty

6.1 Uncertainty of measurement

Nemko USA Inc. has calculated measurement uncertainty and is documented in EMC/MUC/001 "Uncertainty in EMC measurements." Measurement uncertainty was calculated using the methods described in CISPR 16-4-2 Specification for radio disturbance and immunity measuring apparatus and methods – Part 4-2: Uncertainties, statistics, and limit modelling – Measurement instrumentation uncertainty. The expression of Uncertainty in EMC testing. Measurement uncertainty calculations assume a coverage factor of K=2 with 95% certainty.

Table 6.1-1: *Measurement uncertainty calculations*

Measurement		U_{cispr} **dB**	U_{lab} **dB**
Conducted disturbance at AC mains and other port power using a V-AMN	9 kHz to 150 kHz	3.8	2.9
	150 kHz to 30 MHz	3.4	2.3
Conducted disturbance at telecommunication port using AAN	150 kHz to 30 MHz	5.0	4.3
Conducted disturbance at telecommunication port using CVP	150 kHz to 30 MHz	3.9	2.9
Conducted disturbance at telecommunication port using CP	150 kHz to 30 MHz	2.9	1.4
Conducted disturbance at telecommunication port using CP and CVP	150 kHz to 30 MHz	4.0	3.1
Radiated disturbance (electric field strength in a SAC)	30 MHz to 1 GHz	6.3	5.5
Radiated disturbance (electric field strength in a FAR)	1 GHz to 6 GHz	5.2	4.7
Radiated disturbance (electric field strength in a FAR)	6 GHz to 18 GHz	5.5	5.0

Notes: Compliance assessment:

If U_{lab} is less than or equal to U_{cispr} then:

- compliance is deemed to occur is no measured disturbance level exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit

If U_{lab} is greater than U_{cispr} then:

- compliance is deemed to occur is no measured disturbance level, increased by (U_{lab} - U_{cispr}), exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level, increased by (U_{lab} - U_{cispr}), exceeds the disturbance limit

V-AMN: V type artificial mains network
AAN: Asymmetric artificial network
CP: Current probe
CVP: Capacitive voltage probe
SAC: Semi-anechoic chamber
FAR: Fully anechoic room

Section 7 Test equipment

7.1 Test equipment list

Table 7.1-1: *Test Equipment List*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
Signal & Spectrum Analyzer	Rohde & Schwarz	FSW43	E1302	1 year	22-Jan-2025
EMI Test Receiver	Rohde & Schwarz	ESU26.5	E1353	1 year	14-Nov-2024
EMI Test Receiver	Rohde & Schwarz	ESU40	E1121	1 year	03-Oct-2025
System Controller	Sunol Sciences	SC104V	E1191	NCR	NCR
Antenna, Bilog	Schaffner-Chase	CBL6111C	1480	2 years	28-May-2026
Antenna, DRG Horn	ETS-Lindgren	3117-PA	E1139	2 years	11-Jan-2026
Antenna, Standard Gain Horn	Eravant	SAZ-2410-42-S1	EW107	1 year	05-Dec-2024
Notch Filter, 2.4 GHz	Micro-Tonics	BRM50702-02	E1142	NCR	NCR

Notes: NCR: no calibration required
VBU: verify before use

7.2 Test software list

Table 7.2-1: *Test Software*

Manufacturer	Details
Rohde & Schwarz	EMC 32 V10.60.15 (radiated emissions)

Section 8 Testing data

8.1 Variation of power source

8.1.1 References and limits

- FCC 47 CFR Part 15, Subpart A: §15.31(e)
- Test method: ANSI C63.10-2020 §5.13

§15.31(e):
For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery operated equipment, the equipment tests shall be performed using a new battery.

8.1.2 Test summary

Verdict	Pass		
Test date	September 30, 2024	Temperature	20 °C
Test engineer	Lan Sayasane, EMC Test Engineer	Air pressure	1003.0 mbar
Test location	☒ Wireless bench ☐ Other:	Relative humidity	64 %

8.1.3 Notes

Testing was performed with the transmitter operating on a fixed channel (middle) at maximum output power.

8.1.4 Setup details

EUT power input during test	Battery power

8.1.5 Test data

☒	EUT is battery operated. Therefore, all tests performed with a new fully charged battery
☐	EUT power supply voltage varied across supported range. No variation in transmitter output power observed therefore all tests performed at nominal power supply voltage.
☐	EUT power supply voltage varied across supported range. Transmitter output power variation was observed. All tests performed with the EUT operated at the worst-case operating voltage with respect to transmitter output power: V.

8.2 Antenna requirement

8.2.1 References and limits

- FCC 47 CFR Part 15, Subpart C: §15.203

§15.203:
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. Test summary

Verdict	Pass		
Test date	October 3, 2024	Temperature	20 °C
Test engineer	Lan Sayasane, EMC Test Engineer	Air pressure	1004.0 mbar
Test location	☒ Wireless bench ☐ Other:	Relative humidity	66 %

8.2.2 Notes

None

8.2.3 Test data

Antenna part number:	AMCA31-2R450G-S1F-T3
Technical description:	WLAN Ceramic Chip Antenna 2450MHz
Peak gain (dBi):	2.3 dBi
Source of gain data:	☐ Declared by client ☒ Antenna data sheet or specification. Document name: AMCA31-2R450G-S1F-T3, revised: 03-26-24, www.ABRACON.com ☐ Antenna gain test report. Document name:

8.3 Minimum 6 dB bandwidth

8.3.1 References and limits

- FCC 47 CFR Part 15, Subpart C: §15.247(a)(2)
- Test method: ANSI C63.10-2020 §11.8.1

§15.247:

(a) Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:

(2) Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

8.3.2 Test summary

Verdict	Pass		
Test date	September 30, 2024	Temperature	20 °C
Test engineer	Lan Sayasane, EMC Test Engineer	Air pressure	1003.0 mbar
Test location	☒ Wireless bench ☐ Other:	Relative humidity	64 %

8.3.3 Notes

Testing was performed with the transmitter operating on a fixed channel (lowest, middle, and highest) at maximum output power.

The spectral plots within this section have been corrected with all relevant transducer factors.

8.3.4 Setup details

EUT power input during test	Battery
EUT setup configuration	☒ Table-top ☐ Floor standing ☐ Other:

Receiver/spectrum analyzer settings:

Resolution bandwidth	100 kHz
Video bandwidth	300 kHz
Detector mode	Peak
Trace mode	Max Hold
Measurement time	Long enough for trace to stabilize

8.3.5 Test data

Table 8.3-1: *Minimum 6 dB bandwidth test data*

Test Frequency (MHz)	Modulation	DTS Bandwidth (kHz)	Limit (kHz)
2402	GFSK, 1 Mbps	704.755	≥ 500
2440	GFSK, 1 Mbps	678.053	≥ 500
2480	GFSK, 1 Mbps	715.670	≥ 500
2402	GFSK, 2 Mbps	1134.000	≥ 500
2440	GFSK, 2 Mbps	1120.000	≥ 500
2480	GFSK, 2 Mbps	1116.500	≥ 500

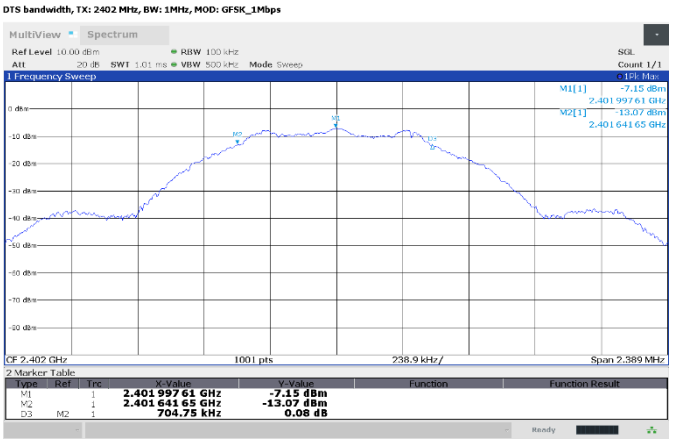

Figure 8.3-1: *Minimum 6 dB bandwidth, GFSK, 1 Mbps, 2402 MHz*

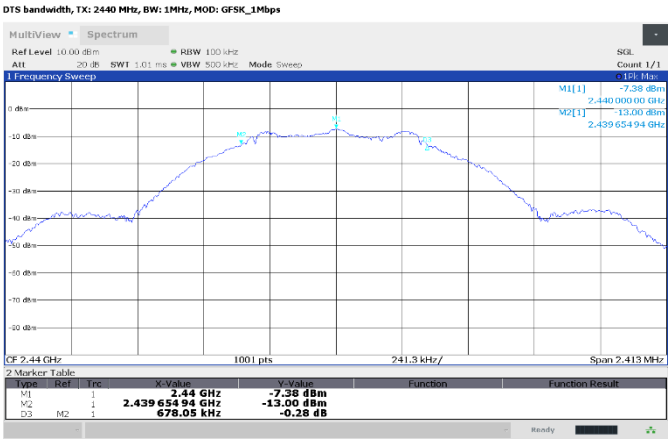

Figure 8.3-2: *Minimum 6 dB bandwidth, GFSK, 1 Mbps, 2440 MHz*

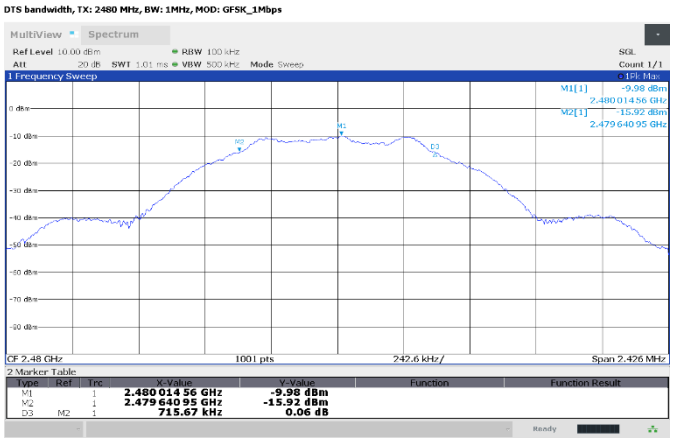

Figure 8.3-3: *Minimum 6 dB bandwidth, GFSK, 1 Mbps, 2480 MHz*

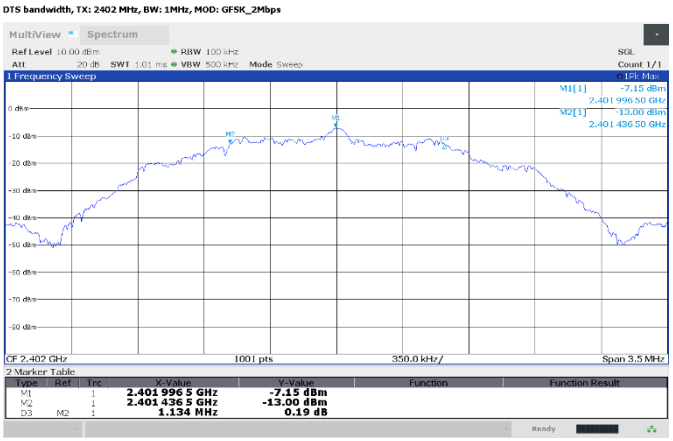

Figure 8.3-4: *Minimum 6 dB bandwidth, GFSK, 2 Mbps, 2402 MHz*

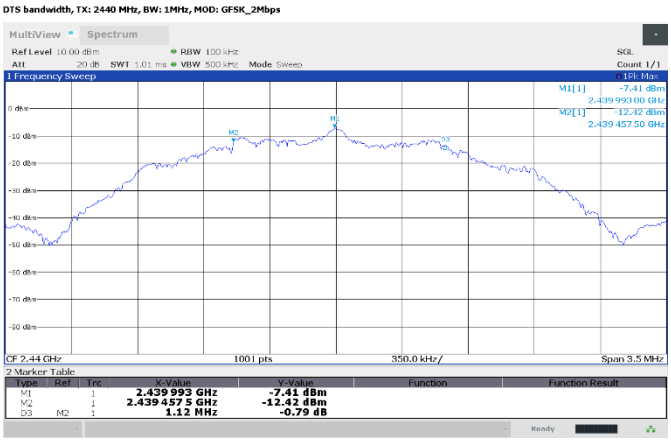

Figure 8.3-5: *Minimum 6 dB bandwidth, GFSK, 2 Mbps, 2440 MHz*

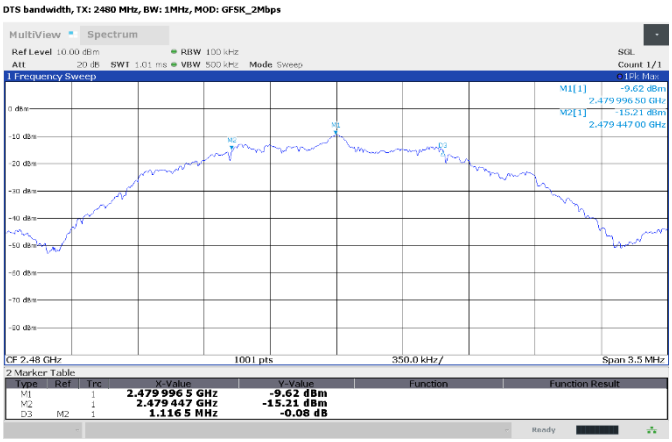

Figure 8.3-6: *Minimum 6 dB bandwidth, GFSK, 2 Mbps, 2480 MHz*

8.4 Maximum peak output power

8.4.1 References and limits

- FCC 47 CFR Part 15, Subpart C: §15.247(b)(3)
- Test method: ANSI C63.10-2020 §11.9.1.1 (RBW ≥ DTS BW)

§15.247:

(b) Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:

(3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

As an alternative to a peak power measurement, compliance can be based on a measurement of the maximum conducted output power. The maximum conducted output power is the total transmit power delivered to all antennas and antenna elements, averaged across all symbols in the signalling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or transmitting at a reduced power level. If multiple modes of operation are implemented, the maximum conducted output power is the highest total transmit power occurring in any mode.

8.4.2 Test summary

Verdict	Pass		
Test date	September 30, 2024	Temperature	20 °C
Test engineer	Lan Sayasane, EMC Test Engineer	Air pressure	1003.0 mbar
Test location	☒ Wireless bench ☐ Other:	Relative humidity	64 %

8.4.3 Notes

Testing was performed with the transmitter operating on a fixed channel (lowest, middle, and highest) at maximum output power.

The spectral plots within this section have been corrected with all relevant transducer factors.

8.4.4 Setup details

EUT power input during test	Battery
EUT setup configuration	☒ Table-top ☐ Floor standing ☐ Other:

Receiver/spectrum analyzer settings:

Resolution bandwidth	1 MHz or 2 MHz depending on measured DTS bandwidth
Video bandwidth	5 MHz or 10 MHz depending on measured DTS bandwidth
Detector mode	Peak
Trace mode	Max Hold
Measurement time	Long enough for trace to stabilize

8.4.5 Test data

Table 8.4-1: *Maximum peak output power test data*

Test Frequency (MHz)	Modulation	Conducted Power (dBm)	Limit (dBm)	Margin (dB)	EIRP (dBm) (For Info Only)
2402	GFSK, 1 Mbps	-6.69	≤ 30	36.69	-4.98
2440	GFSK, 1 Mbps	-7.28	≤ 30	37.28	-4.99
2480	GFSK, 1 Mbps	-9.47	≤ 30	39.47	-7.23
2402	GFSK, 2 Mbps	-6.71	≤ 30	36.71	-7.24
2440	GFSK, 2 Mbps	-7.29	≤ 30	37.29	-7.17
2480	GFSK, 2 Mbps	-9.35	≤ 30	39.35	-7.05

Note: EIRP provided for information. EIRP = conducted power (dBm) + antenna gain (dBi)

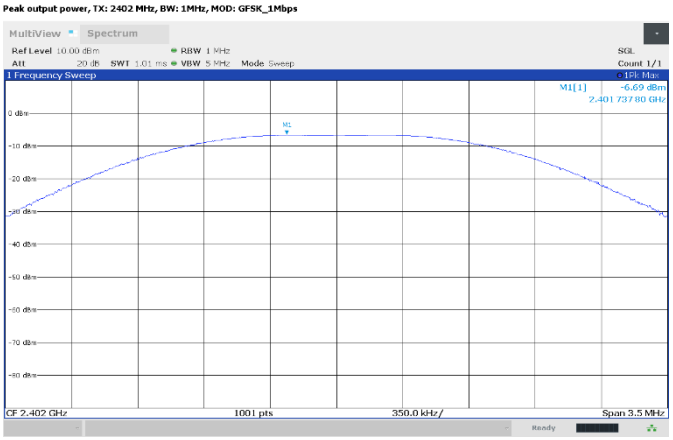

Figure 8.4-1: *Maximum peak output power, GFSK, 1 Mbps, 2402 MHz*

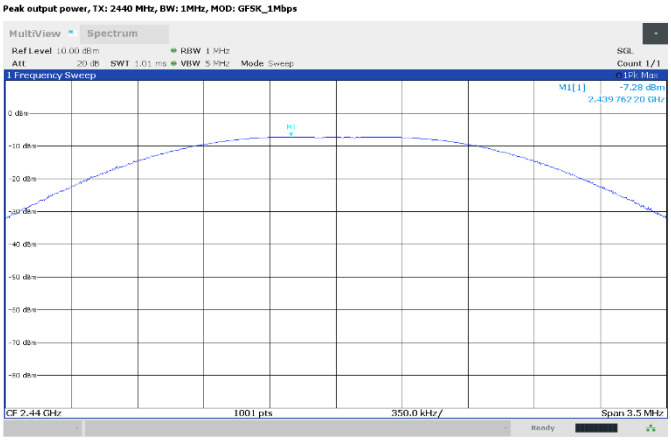

Figure 8.4-2: *Maximum peak output power, GFSK, 1 Mbps, 2440 MHz*

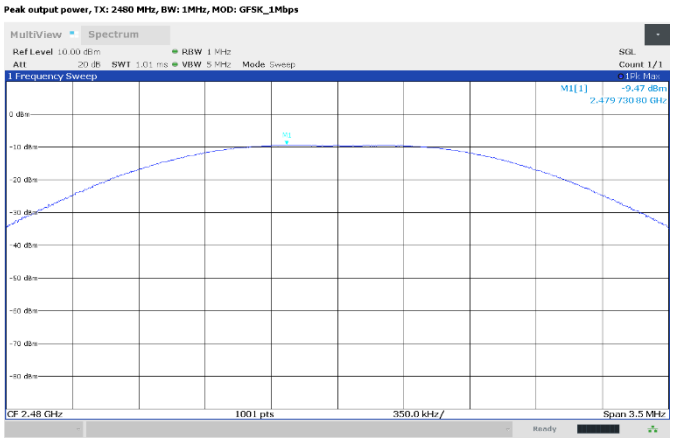

Figure 8.4-3: *Maximum peak output power, GFSK, 1 Mbps, 2480 MHz*

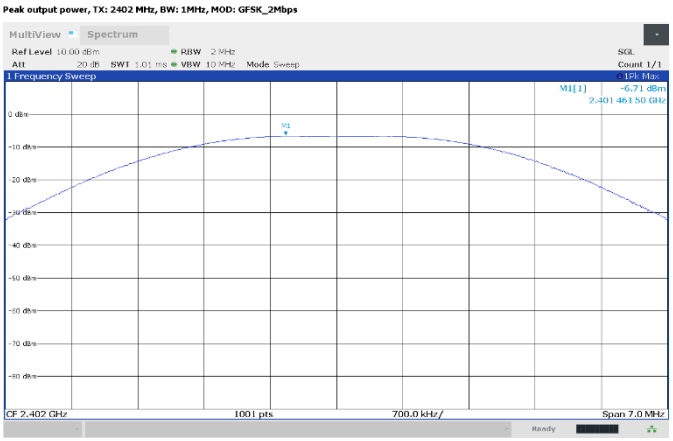

Figure 8.4-4: *Maximum peak output power, GFSK, 2 Mbps, 2402 MHz*

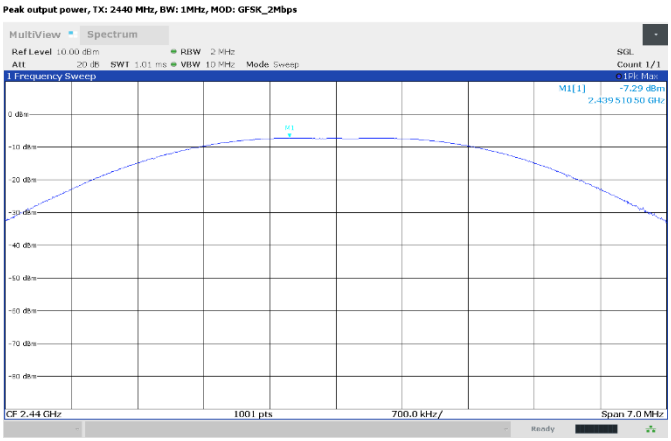

Figure 8.4-5: *Maximum peak output power, GFSK, 2 Mbps, 2440 MHz*

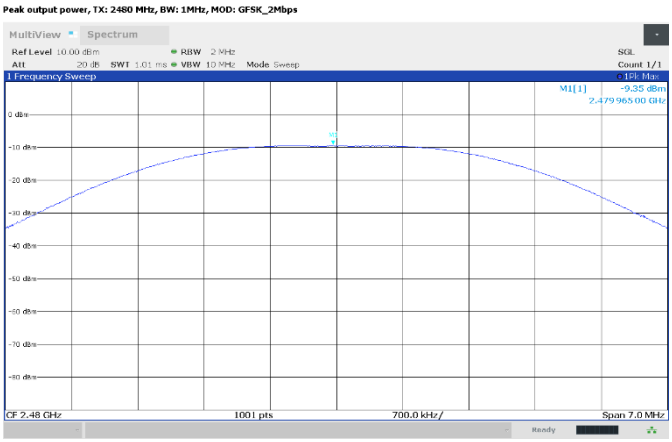

Figure 8.4-6: *Maximum peak output power, GFSK, 2 Mbps, 2480 MHz*

8.5 Spurious emissions

8.5.1 References and limits

- FCC 47 CFR Part 15, Subpart C: §15.247(d)
- Test method: ANSI C63.10-2020 §6.10.4 (authorized band edge)
- Test method: ANSI C63.10-2020 §11.11 (antenna port conducted spurious emissions)
- Test method: ANSI C63.10-2020 §11.12.3 (radiated restricted band edge)
- Test method: ANSI C63.10-2020 §6.5, 6.6 (radiated emissions in restricted bands)

§15.247:

(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a) (see § 15.205(c)).

Table 8.5-1: *FCC §15.209 – Radiated emission limits*

Frequency, MHz	Field strength of emissions		Measurement distance, m
	µV/m	dBµV/m	
0.009–0.490	2400/F	$67.6 - 20 \times \log_{10}(F)$	300
0.490–1.705	24000/F	$87.6 - 20 \times \log_{10}(F)$	30
1.705–30.0	30	29.5	30
30–88	100	40.0	3
88–216	150	43.5	3
216–960	200	46.0	3
above 960	500	54.0	3

Notes: In the emission table above, the tighter limit applies at the band edges.
For frequencies above 1 GHz the limit on peak RF emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test.

Table 8.5-2: *FCC restricted frequency bands*

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
0.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2690–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	Above 38.6
13.36–13.41			

8.5.2 Test summary

Verdict	Pass		
Test date	September 30, 2024 - Conducted	Temperature	20 °C
Test date	October 1, 2024 - Radiated		
Test engineer	Lan Sayasane, EMC Test Engineer	Air pressure	1003.0 mbar
Test location	☒ Wireless bench (conducted tests) ☐ 10 m semi-anechoic chamber (radiated tests) ☒ 3 m semi-anechoic chamber (radiated tests) ☐ Other:	Relative humidity	64 %

8.5.3 Notes

Testing was performed with the transmitter operating on a fixed channel at full power. Low, middle, and high channels were tested. The spectrum was searched from 30 MHz to 26 GHz (above the 10th harmonic of the highest transmit frequency).

For radiated measurements, the EUT was investigated to identify the worst case orientation with respect to the fundamental transmitter power. All measurements were performed with the EUT in that worst-case orientation.

The spectral plots within this section have been corrected with all relevant transducer factors.

8.5.4 Setup details

EUT power input during test	Battery
EUT setup configuration	☒ Table-top ☐ Floor standing ☐ Other:

Spectrum analyzer settings (conducted emissions):

Resolution bandwidth	100 kHz
Video bandwidth	300 kHz
Detector mode	Peak
Trace mode	Max Hold
Measurement time	Long enough for trace to stabilize

Receiver settings for radiated measurements within restricted bands below 1 GHz:

Resolution bandwidth	120 kHz
Video bandwidth	300 kHz
Detector mode	Peak (preview measurements) Quasi-Peak (final measurements)

Receiver settings for radiated measurements within restricted bands above 1 GHz:

Resolution bandwidth	1 MHz
Video bandwidth	3 MHz
Detector mode	Peak (preview measurements) Peak and average (final measurements)

8.5.5 Test data

Antenna port conducted spurious emissions:

- **Authorized band edge:**

Table 8.5-3: *Authorized band edge conducted emissions (antenna port)*

Test Frequency (MHz)	Modulation	Frequency of highest emission (MHz)	Amplitude (dBm)	Limit (dBm)	Margin (dB)
2402	GFSK, 1 Mbps	2399.996	-55.21	-26.77	28.44
2480	GFSK, 1 Mbps	2483.531	-64.13	-29.49	34.65
2402	GFSK, 2 Mbps	2399.986	-39.24	-26.80	12.44
2480	GFSK, 2 Mbps	2483.499	-63.94	-29.47	34.47

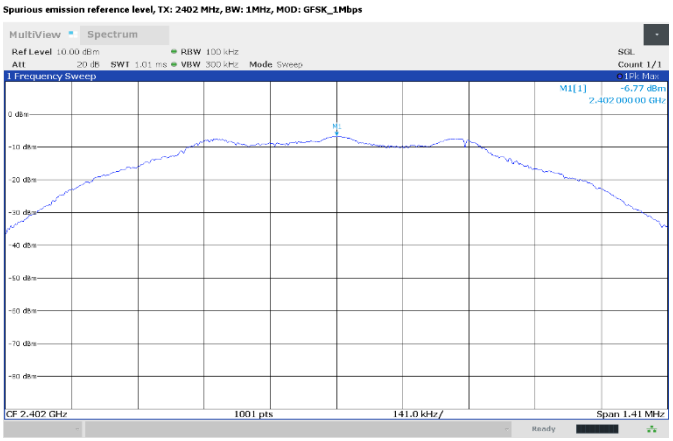

Figure 8.5-1: *Authorized band-edge emissions, reference level, GFSK, 1 Mbps, 2402 MHz*

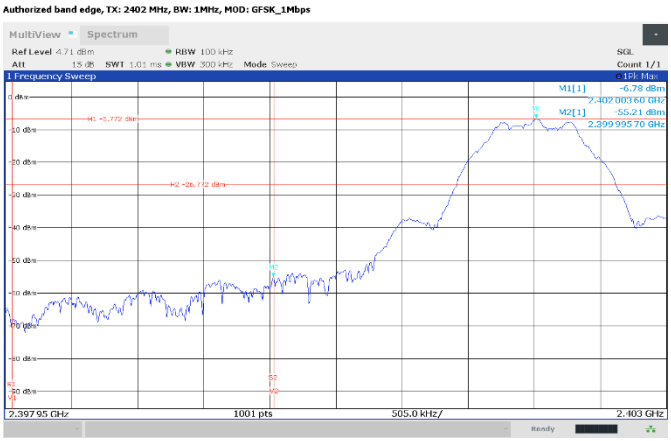

Figure 8.5-2: *Authorized band-edge emissions, GFSK, 1 Mbps, 2402 MHz*

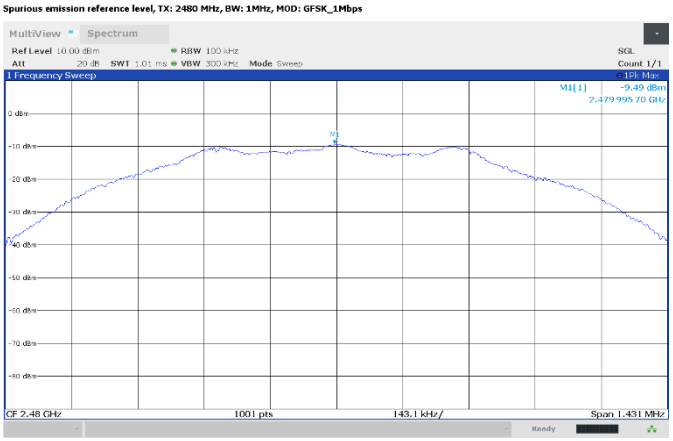

Figure 8.5-3: *Authorized band-edge emissions, reference level, GFSK, 1 Mbps, 2480 MHz*

Figure 8.5-4: *Authorized band-edge emissions, GFSK, 1 Mbps, 2480 MHz*

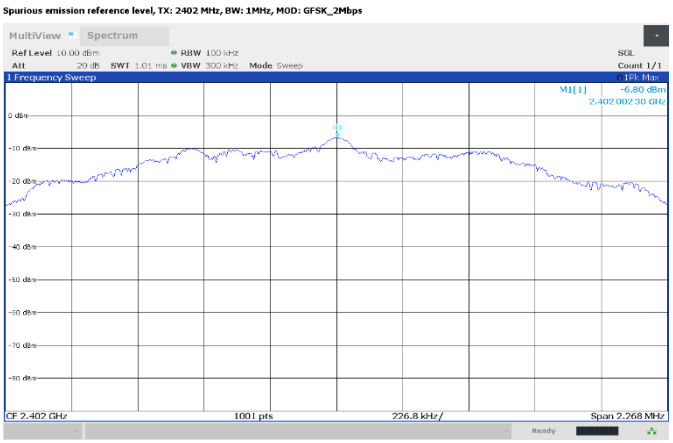

Figure 8.5-5: *Authorized band-edge emissions, reference level, GFSK 2 Mbps, 2402 MHz*

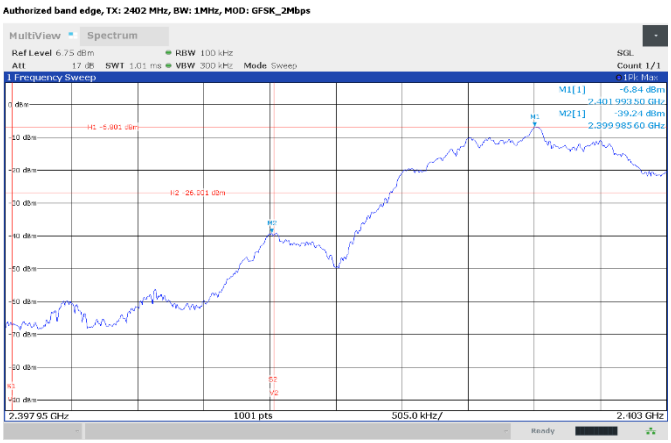

Figure 8.5-6: *Authorized band-edge emissions, GFSK, 2 Mbps, 2402 MHz*

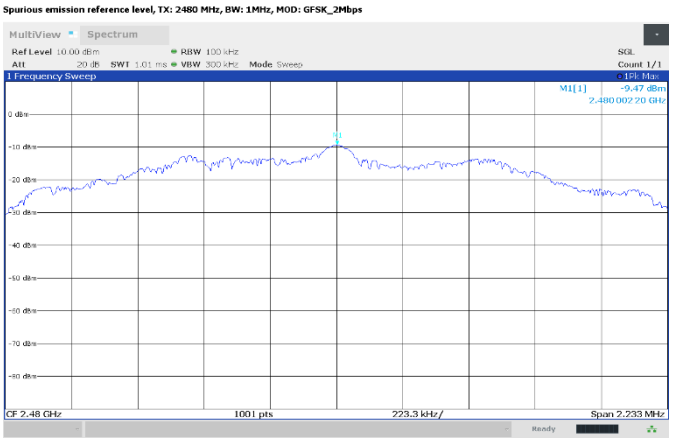

Figure 8.5-7: *Authorized band-edge emissions, reference level, GFSK, 2 Mbps, 2480 MHz*

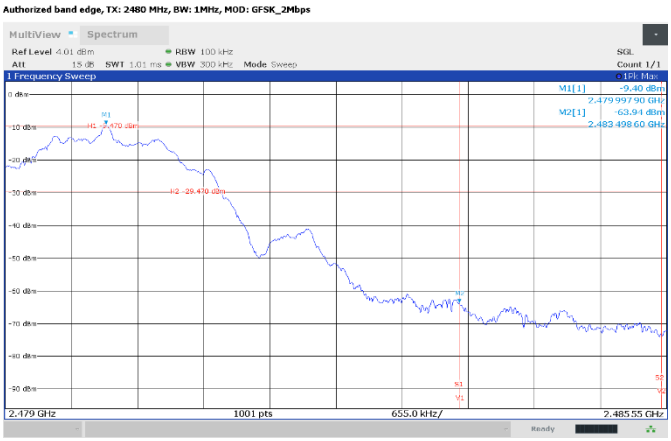

Figure 8.5-8: *Authorized band-edge emissions, GFSK, 2 Mbps, 2480 MHz*

- **Antenna port conducted spurious emissions:**

Table 8.5-4: *Antenna port conducted spurious emissions*

Test Frequency (MHz)	Modulation	Frequency of highest emission (MHz)	Amplitude (dBm)	Limit (dBm)	Margin (dB)
2402	GFSK, 1 Mbps	No significant emissions			
2440	GFSK, 1 Mbps	No significant emissions			
2480	GFSK, 1 Mbps	No significant emissions			
2402	GFSK, 2 Mbps	No significant emissions			
2440	GFSK, 2 Mbps	No significant emissions			
2480	GFSK, 2 Mbps	No significant emissions			

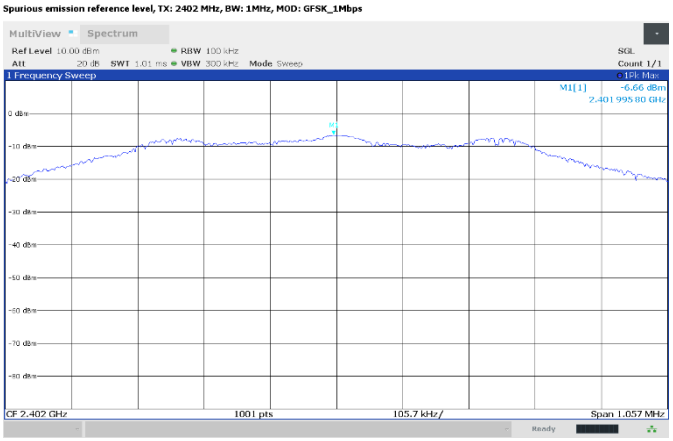

Figure 8.5-9: *Antenna port conducted spurious emissions, reference level, GFSK, 1 Mbps, 2402 MHz*

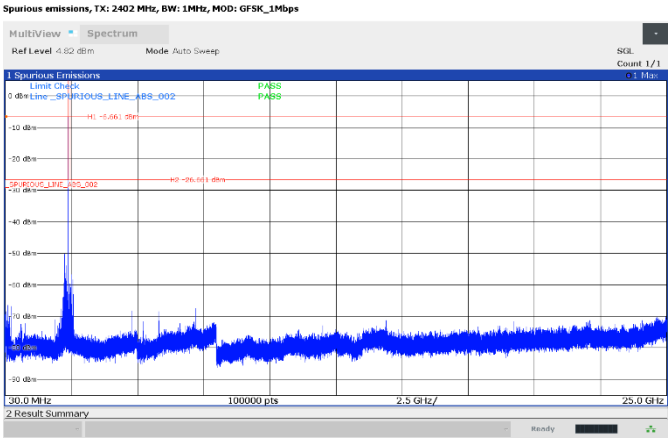

Figure 8.5-10: *Antenna port conducted spurious emissions, GFSK, 1 Mbps, 2402 MHz*

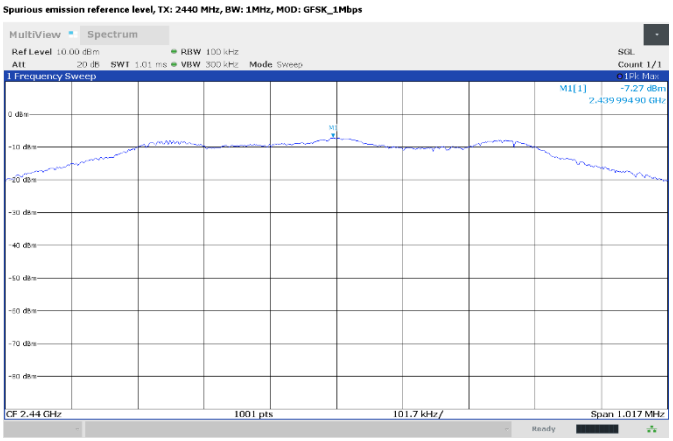

Figure 8.5-11: *Antenna port conducted spurious emissions, reference level, GFSK, 1 Mbps, 2440 MHz*

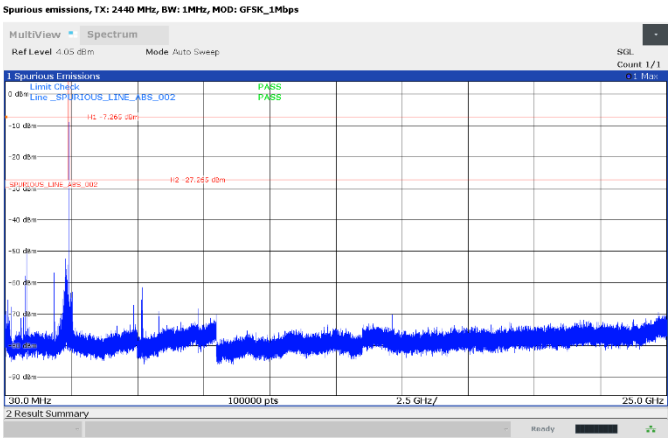

Figure 8.5-12: *Antenna port conducted spurious emissions, GFSK, 1 Mbps, 2440 MHz*

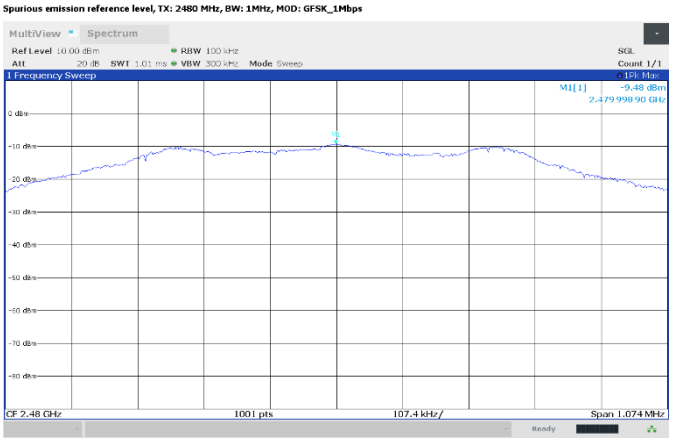

Figure 8.5-13: *Antenna port conducted spurious emissions, reference level, GFSK, 1 Mbps, 2480 MHz*

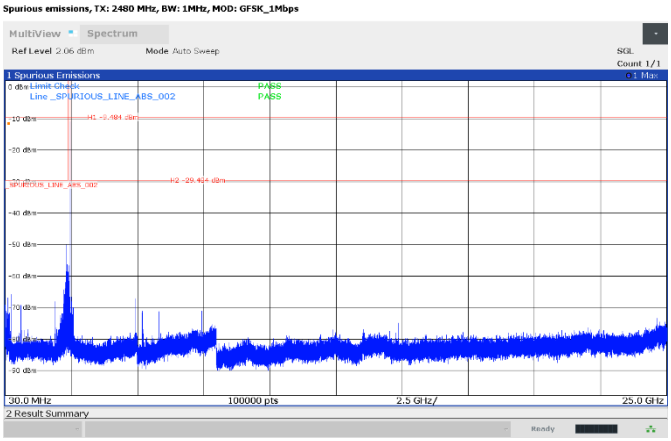

Figure 8.5-14: *Antenna port conducted spurious emissions, GFSK, 1 Mbps, 2480 MHz*

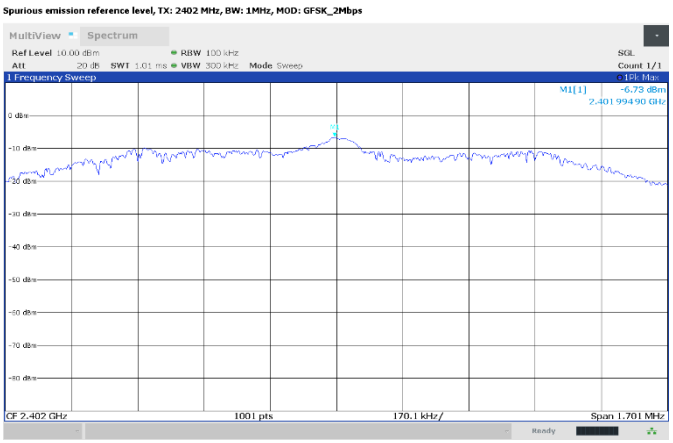

Figure 8.5-15: *Antenna port conducted spurious emissions, reference level, GFSK, 2 Mbps, 2402 MHz*

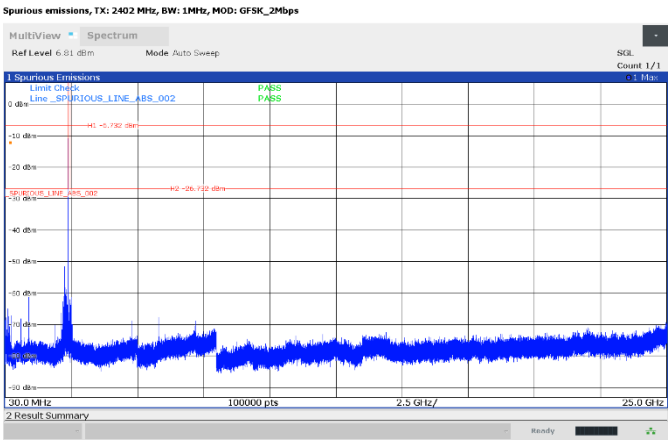

Figure 8.5-16: *Antenna port conducted spurious emissions, GFSK, 2 Mbps, 2402 MHz*

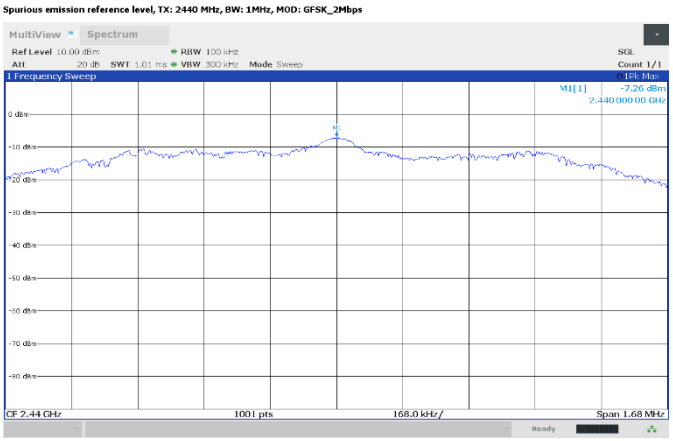

Figure 8.5-17: *Antenna port conducted spurious emissions, reference level, GFSK, 2 Mbps, 2440 MHz*

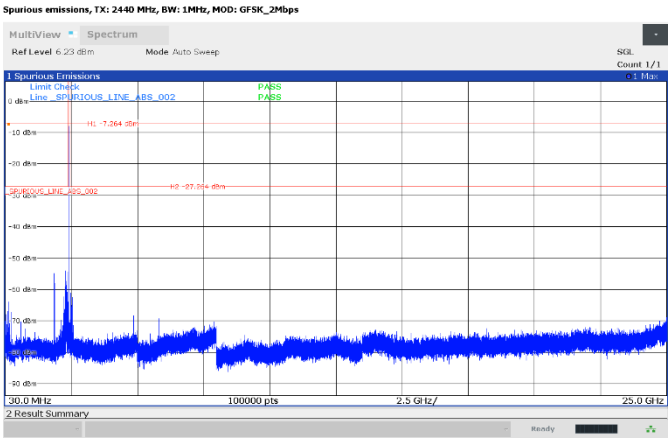

Figure 8.5-18: *Antenna port conducted spurious emissions, GFSK, 2 Mbps, 2440 MHz*

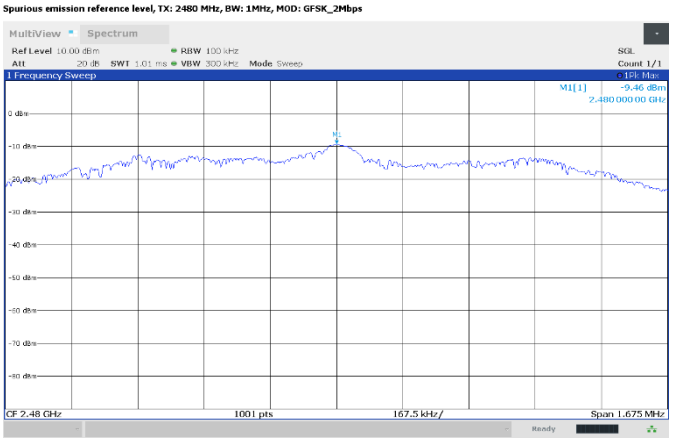

Figure 8.5-19: *Antenna port conducted spurious emissions, reference level, GFSK, 2 Mbps, 2480 MHz*

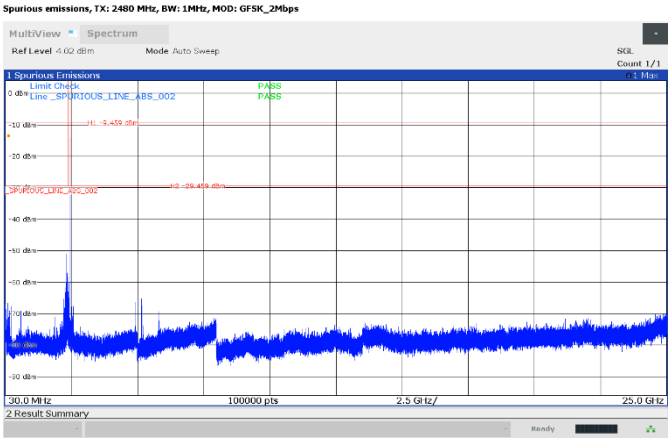

Figure 8.5-20: *Antenna port conducted spurious emissions, GFSK, 2 Mbps, 2480 MHz*

Radiated spurious emissions:

- **Restricted band edge:**

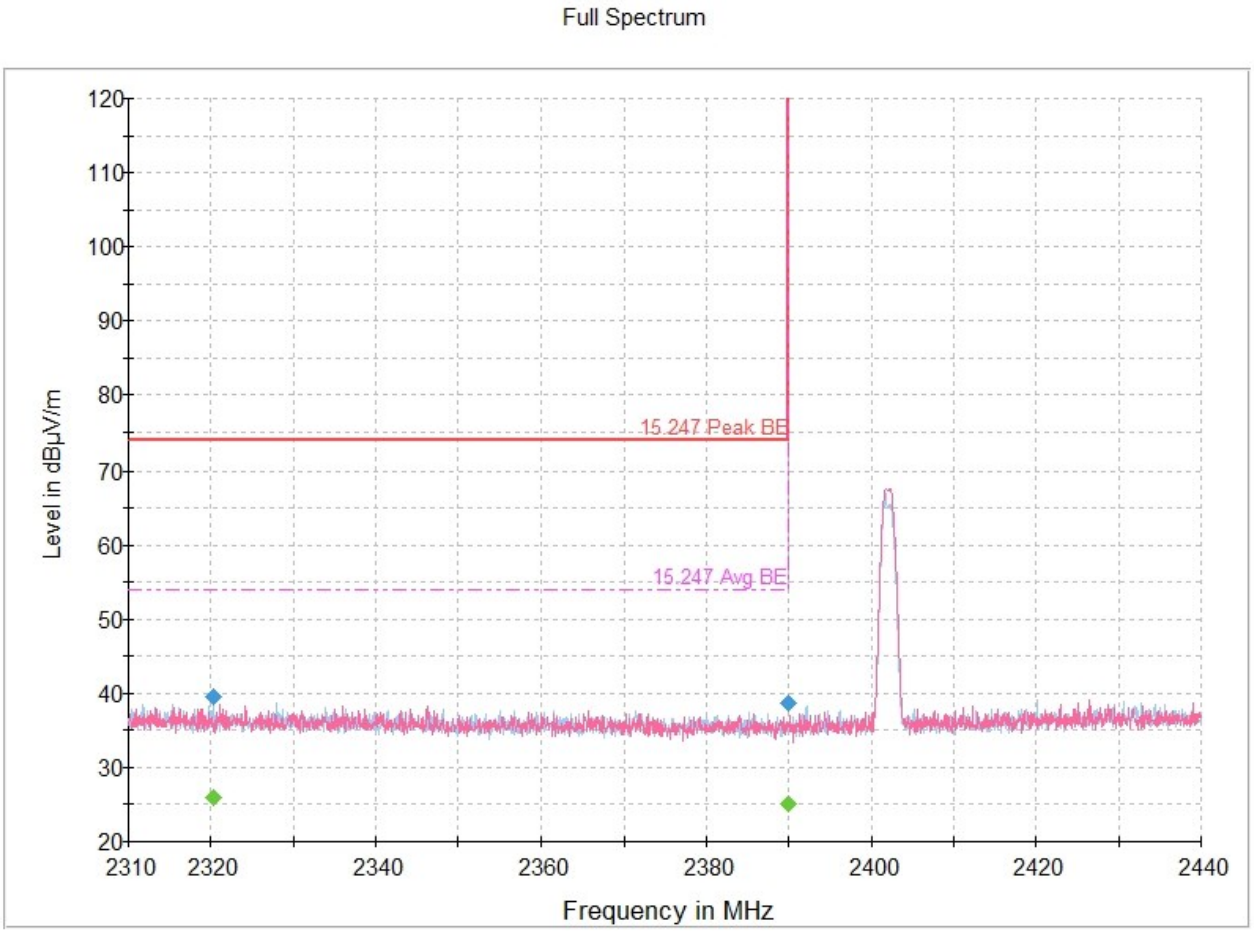

Figure 8.5-21: *Radiated emissions spectral plot (2.31 GHz - 2.44 GHz) – 2402 MHz (1Mbps, GFSK)*

Table 8.5-5*: Radiated emissions results*

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2320.335000	---	25.90	53.90	28.00	5000.0	1000.000	212.0	H	0.0	-9.2
2320.335000	39.54	---	73.90	34.36	5000.0	1000.000	212.0	H	0.0	-9.2
2390.000000	---	25.04	53.90	28.86	5000.0	1000.000	294.0	V	99.0	-8.8
2390.000000	38.78	---	73.90	35.12	5000.0	1000.000	294.0	V	99.0	-8.8

Notes: [1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factors = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

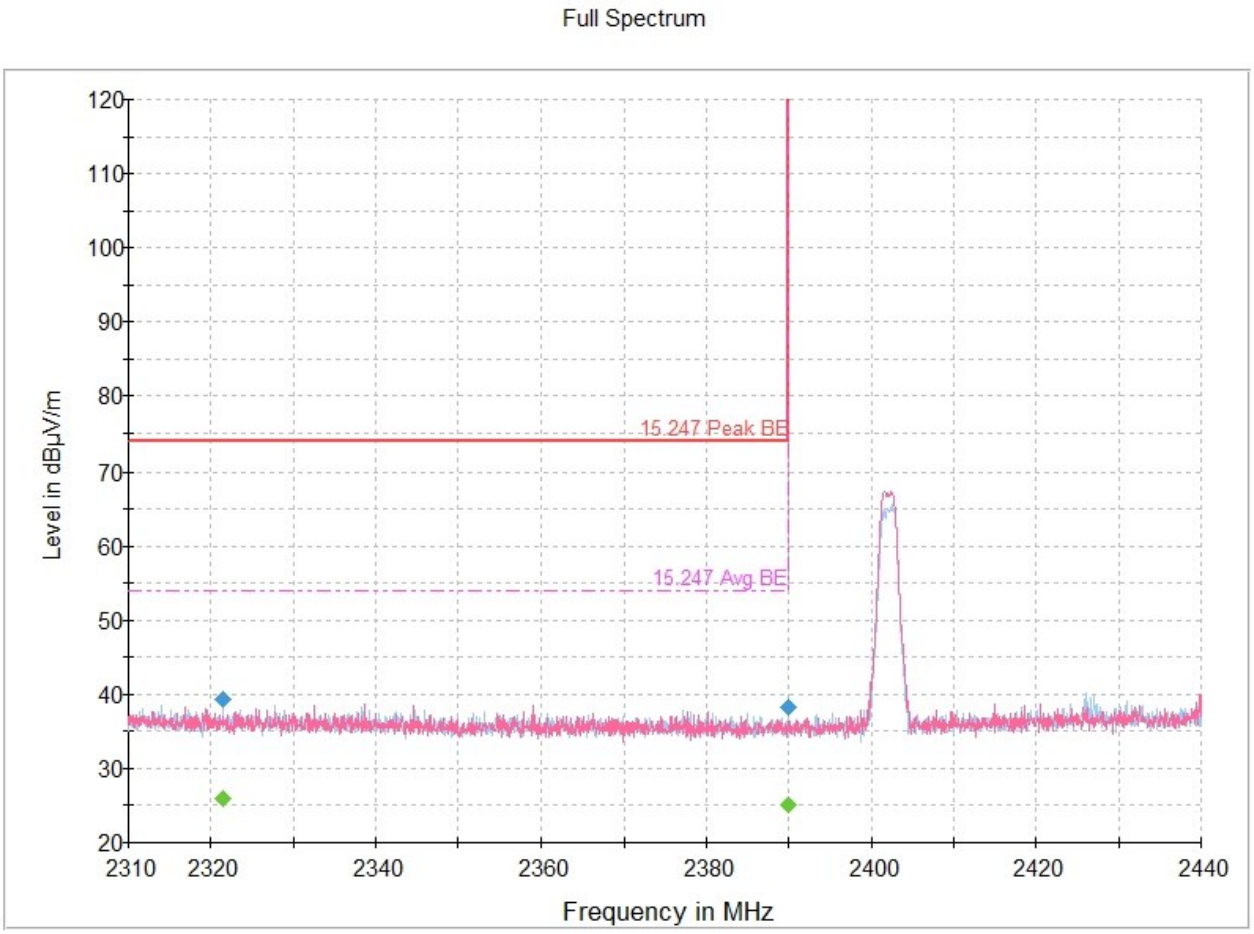

Figure 8.5-22: *Radiated emissions spectral plot (2.31 GHz - 2.44 GHz) – 2402 MHz (2Mbps, GFSK)*

Table 8.5-6*: Radiated emissions results*

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2321.440000	---	25.86	53.90	28.04	5000.0	1000.000	328.0	V	136.0	-9.2
2321.440000	39.31	---	73.90	34.59	5000.0	1000.000	328.0	V	136.0	-9.2
2390.000000	---	25.02	53.90	28.88	5000.0	1000.000	385.0	V	300.0	-8.8
2390.000000	38.23	---	73.90	35.67	5000.0	1000.000	385.0	V	300.0	-8.8

Notes: [1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factors = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

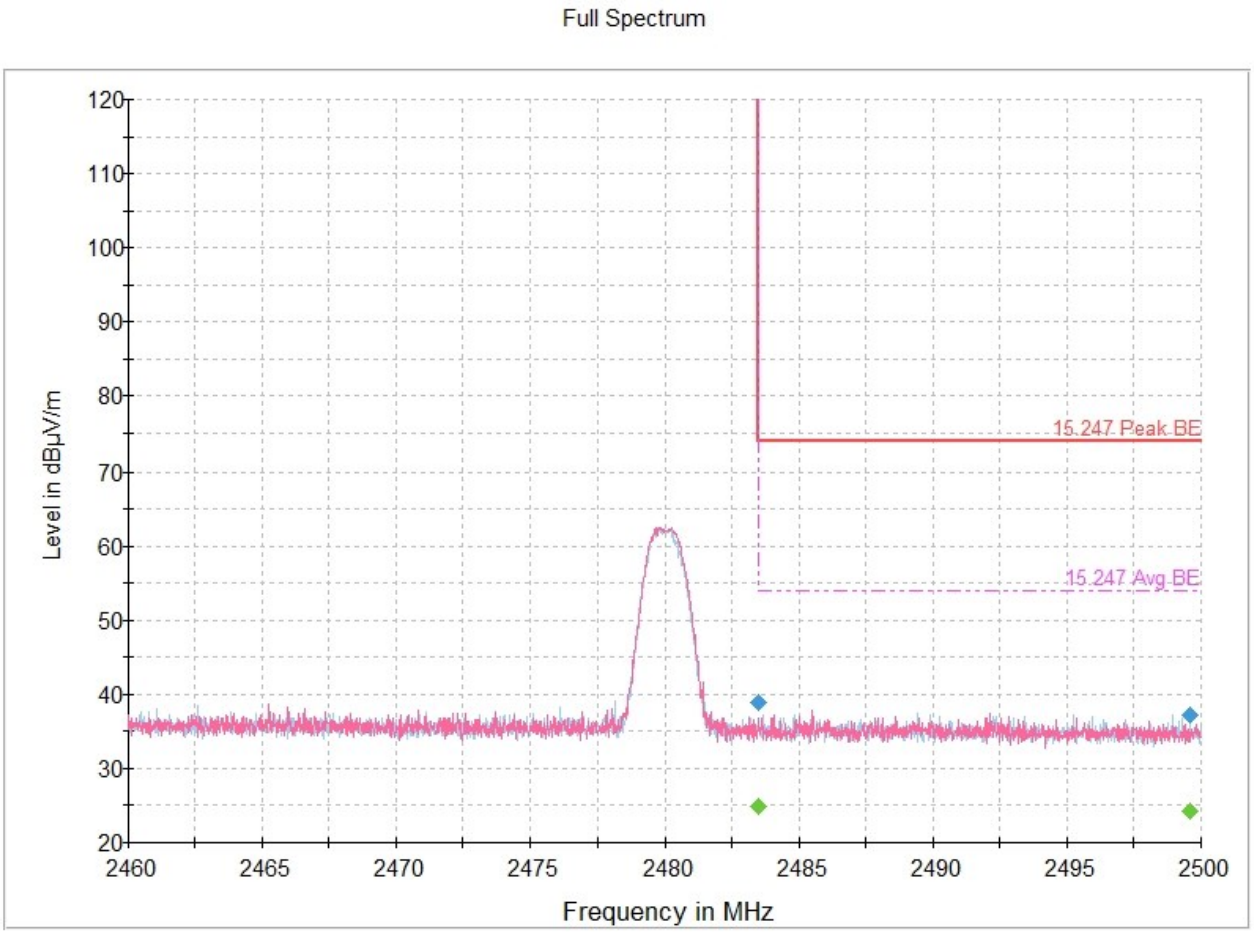

Figure 8.5-23: *Radiated emissions spectral plot (2.46 GHz - 2.5 GHz) – 2480 MHz (1Mbps, GFSK)*

Table 8.5-7*: Radiated emissions results*

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2483.500000	---	24.84	53.90	29.06	5000.0	1000.000	180.0	V	162.0	-8.4
2483.500000	38.91	---	73.90	34.99	5000.0	1000.000	180.0	V	162.0	-8.4
2499.580000	---	24.34	53.90	29.56	5000.0	1000.000	315.0	V	304.0	-8.4
2499.580000	37.14	---	73.90	36.76	5000.0	1000.000	315.0	V	304.0	-8.4

Notes: [1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factors = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

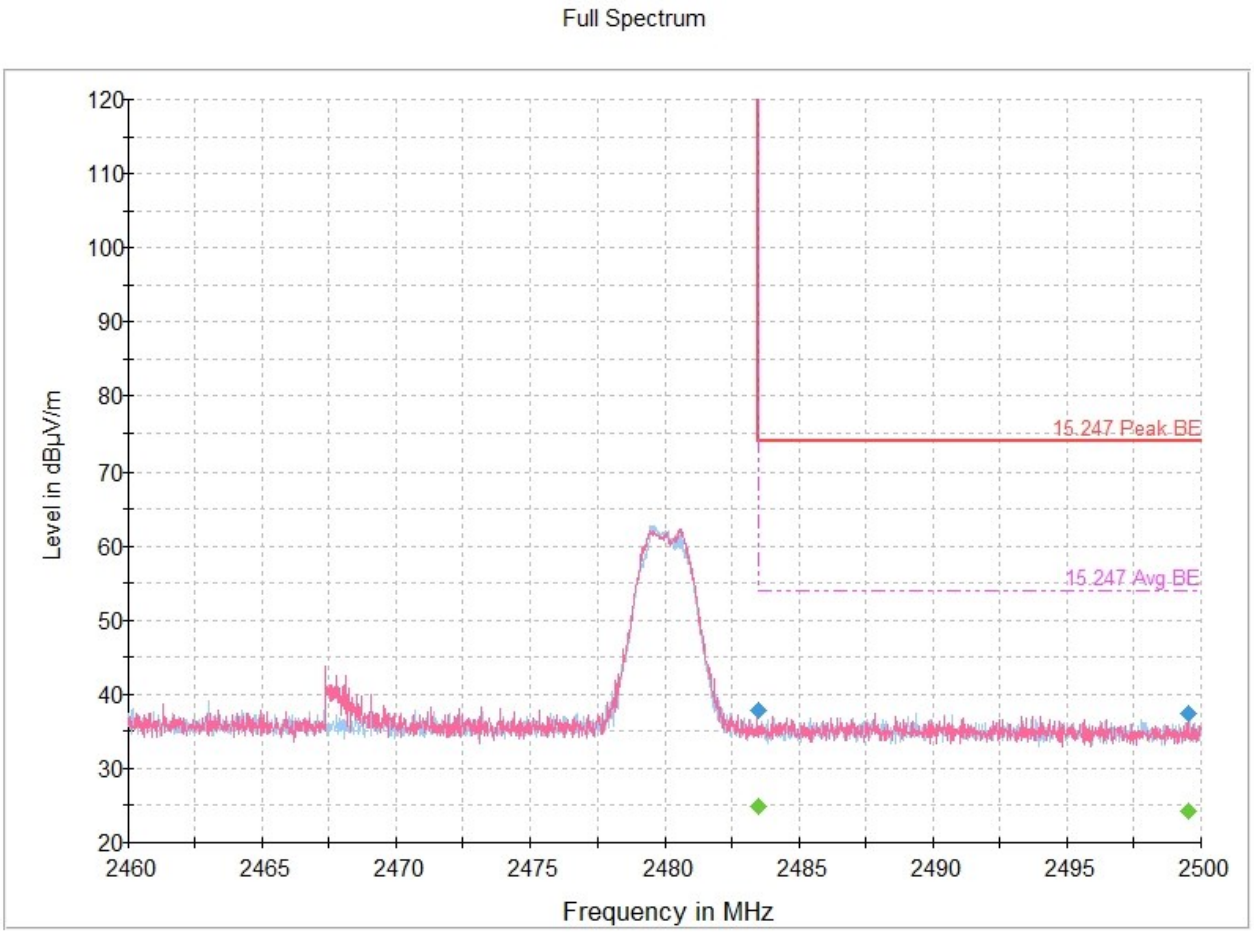

Figure 8.5-24: *Radiated emissions spectral plot (2.46 GHz - 2.5 GHz) – 2480 MHz (2Mbps, GFSK)*

Table 8.5-8*: Radiated emissions results*

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2483.500000	37.90	---	73.90	36.00	5000.0	1000.000	235.0	V	25.0	-8.4
2483.500000	---	24.85	53.90	29.05	5000.0	1000.000	235.0	V	25.0	-8.4
2499.520000	37.50	---	73.90	36.40	5000.0	1000.000	166.0	H	124.0	-8.4
2499.520000	---	24.33	53.90	29.57	5000.0	1000.000	166.0	H	124.0	-8.4

Notes: [1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factors = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

- **Radiated spurious emissions, restricted bands:**

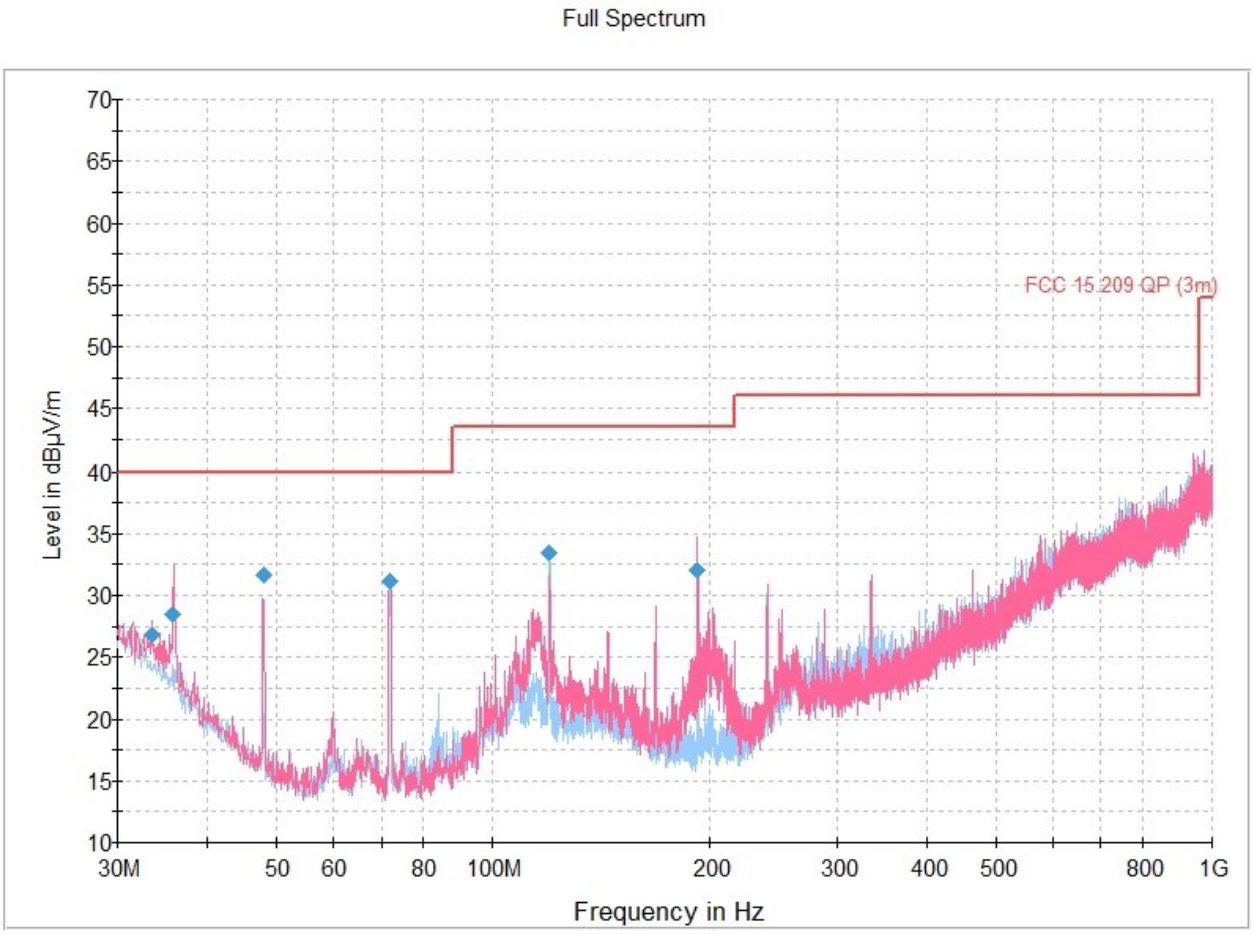

Figure 8.5-25: *Radiated emissions spectral plot (30 MHz - 1 GHz) – 2402 MHz (1Mbps, GFSK)*

Table 8.5-9*: Radiated emissions results*

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
33.452000	26.80	40.00	13.20	5000.0	120.000	108.0	V	68.0	23.2
35.877000	28.51	40.00	11.49	5000.0	120.000	104.0	V	358.0	21.7
47.911000	31.70	40.00	8.30	5000.0	120.000	108.0	V	0.0	15.2
72.041000	31.15	40.00	8.85	5000.0	120.000	231.0	H	263.0	13.2
119.999000	33.47	43.50	10.03	5000.0	120.000	253.0	H	274.0	18.4
192.070000	31.99	43.50	11.51	5000.0	120.000	114.0	V	21.0	16.2

Notes: [1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factors = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

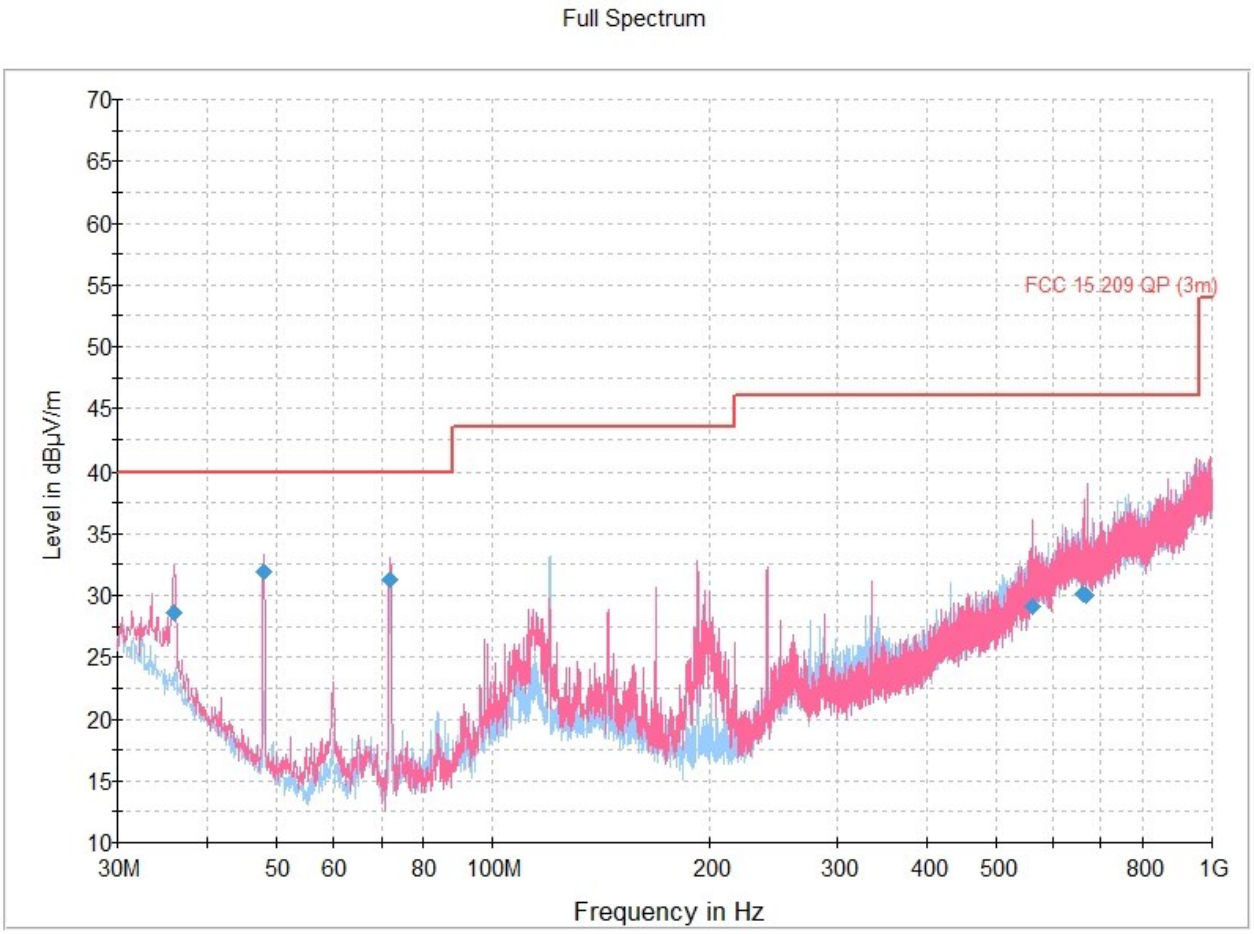

Figure 8.5-26: *Radiated emissions spectral plot (30 MHz - 1 GHz) – 2402 MHz (2Mbps, GFSK)*

Table 8.5-10*: Radiated emissions results*

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
35.974000	28.66	40.00	11.34	5000.0	120.000	157.0	V	180.0	21.7
48.002000	31.96	40.00	8.04	5000.0	120.000	111.0	V	0.0	15.2
72.001000	31.25	40.00	8.75	5000.0	120.000	140.0	V	130.0	13.2
562.056000	29.14	46.00	16.86	5000.0	120.000	111.0	V	147.0	29.0
662.187000	30.11	46.00	15.89	5000.0	120.000	171.0	V	58.0	30.1
668.846000	29.95	46.00	16.05	5000.0	120.000	363.0	V	106.0	30.1

Notes: [1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factors = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

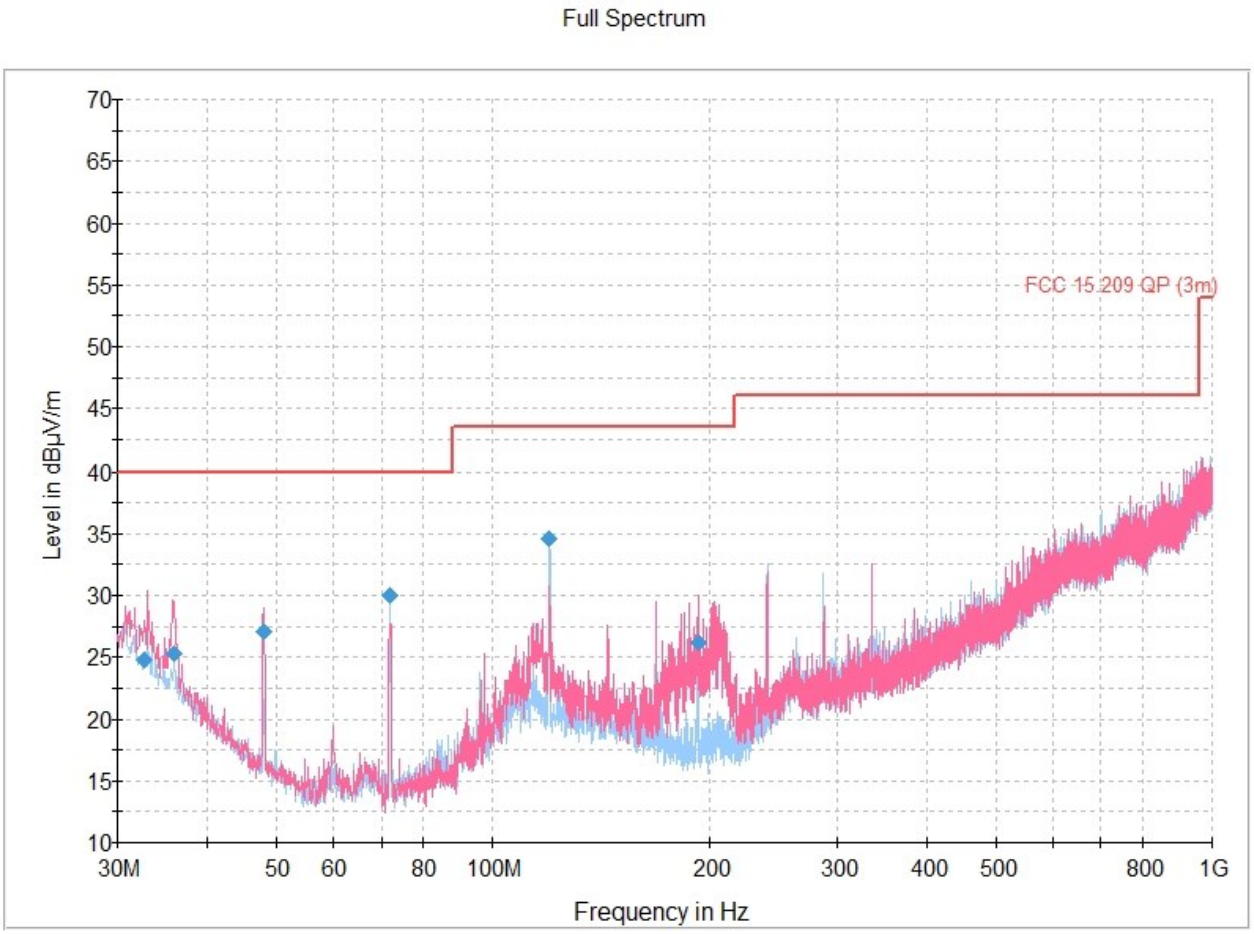

Figure 8.5-27: *Radiated emissions spectral plot (30 MHz - 1 GHz) – 2440 MHz (1Mbps, GFSK)*

Table 8.5-11*: Radiated emissions results*

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
32.664000	24.72	40.00	15.28	5000.0	120.000	150.0	V	182.0	23.6
35.923000	25.32	40.00	14.68	5000.0	120.000	104.0	V	44.0	21.7
48.025000	27.01	40.00	12.99	5000.0	120.000	104.0	V	21.0	15.2
71.984000	29.98	40.00	10.02	5000.0	120.000	216.0	H	285.0	13.2
119.999000	34.53	43.50	8.97	5000.0	120.000	249.0	H	117.0	18.4
192.458000	26.15	43.50	17.35	5000.0	120.000	104.0	V	21.0	16.2

Notes:
[1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factors = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

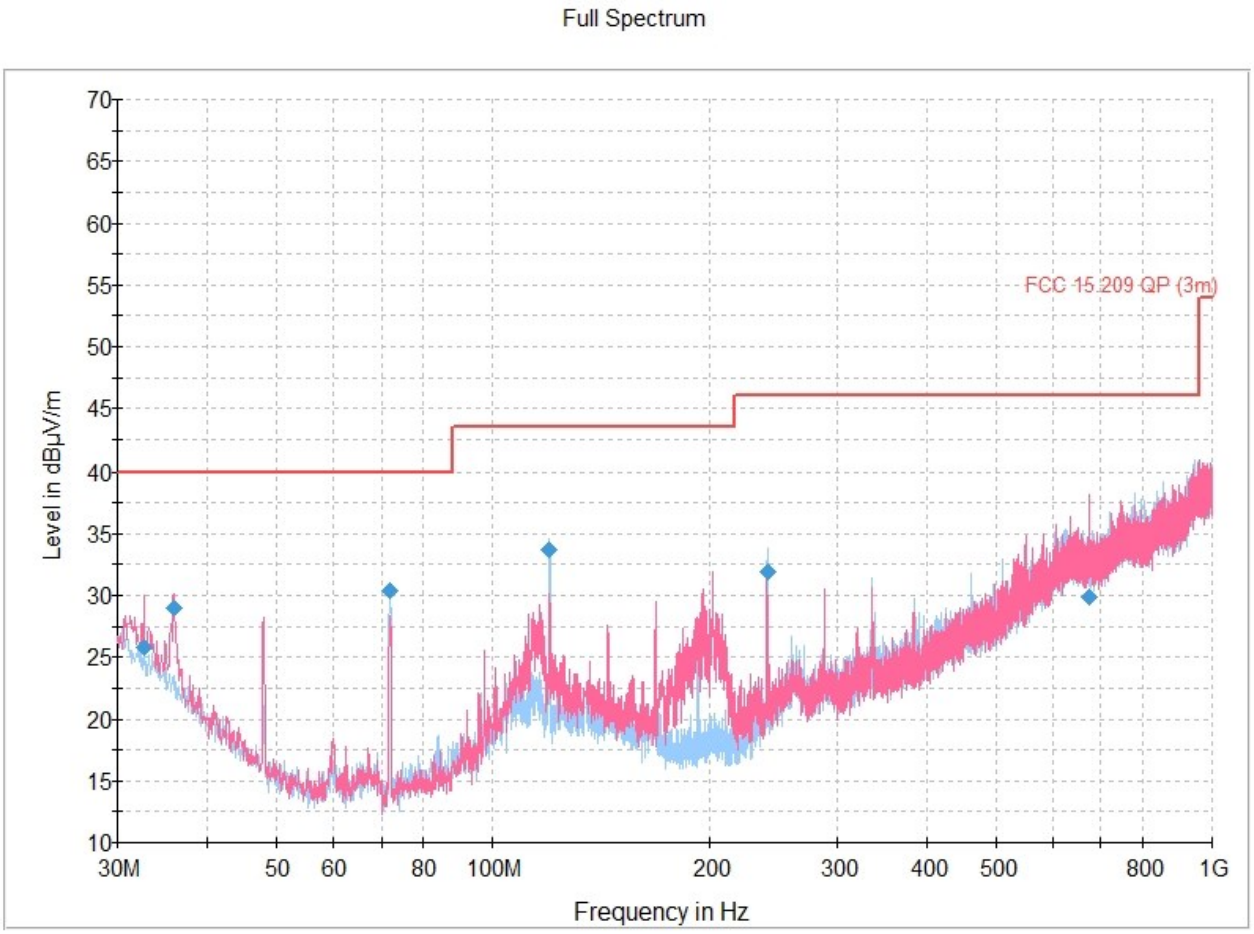

Figure 8.5-28: *Radiated emissions spectral plot (30 MHz - 1 GHz) – 2440 MHz (2Mbps, GFSK)*

Table 8.5-12*: Radiated emissions results*

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
32.699000	25.83	40.00	14.17	5000.0	120.000	114.0	V	346.0	23.6
36.037000	28.92	40.00	11.08	5000.0	120.000	111.0	V	20.0	21.6
72.024000	30.35	40.00	9.65	5000.0	120.000	239.0	H	274.0	13.2
119.999000	33.68	43.50	9.82	5000.0	120.000	260.0	H	104.0	18.4
240.022000	31.93	46.00	14.07	5000.0	120.000	111.0	H	248.0	19.1
673.115000	29.93	46.00	16.07	5000.0	120.000	379.0	V	152.0	30.1

Notes: [1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factors = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

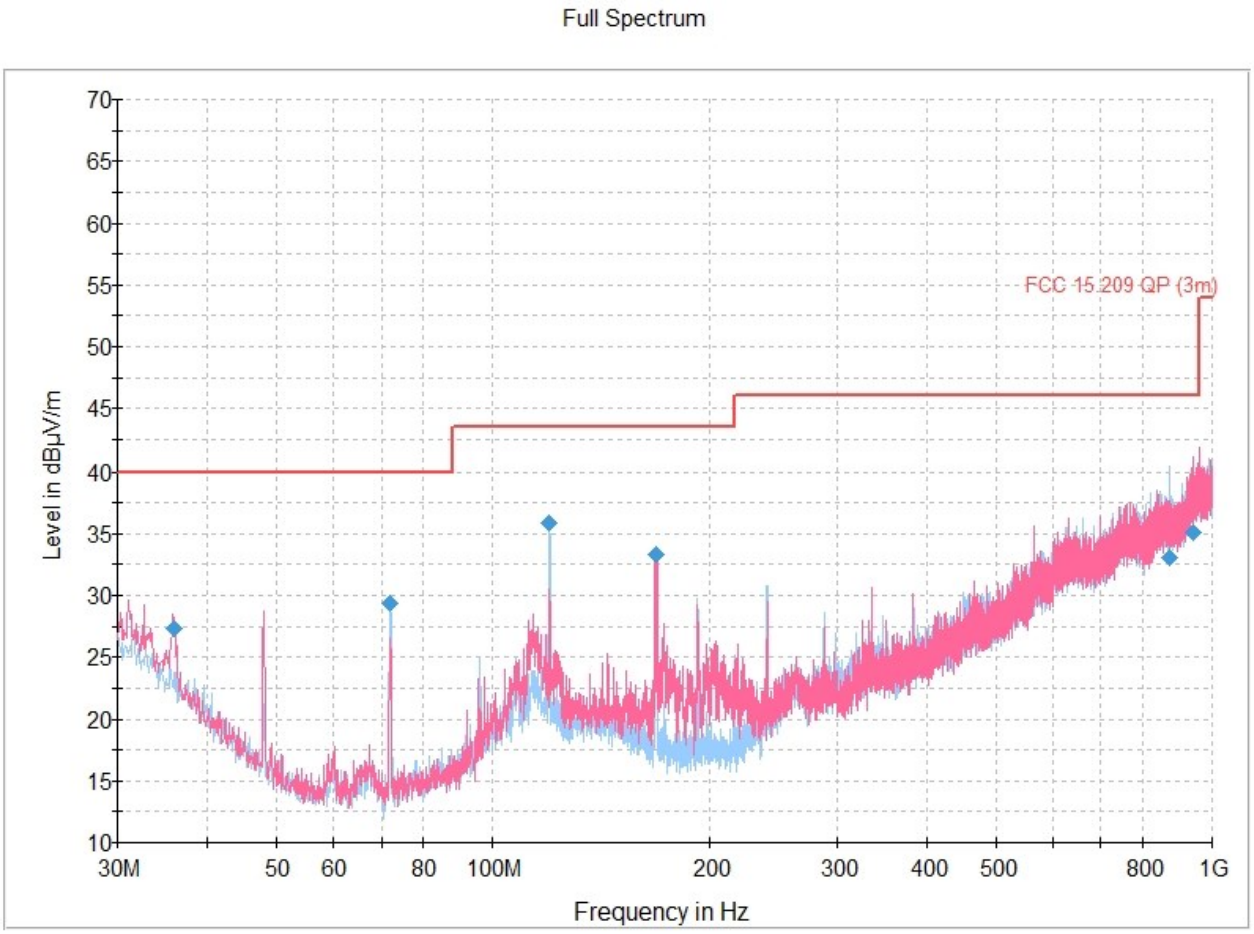

Figure 8.5-29: *Radiated emissions spectral plot (30 MHz - 1 GHz) – 2480 MHz (1Mbps, GFSK)*

Table 8.5-13*: Radiated emissions results*

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
35.980000	27.33	40.00	12.67	5000.0	120.000	104.0	V	0.0	21.7
71.984000	29.42	40.00	10.58	5000.0	120.000	227.0	H	268.0	13.2
120.022000	35.87	43.50	7.63	5000.0	120.000	246.0	H	118.0	18.4
167.974000	33.29	43.50	10.21	5000.0	120.000	104.0	V	182.0	16.9
870.287000	33.08	46.00	12.92	5000.0	120.000	329.0	H	302.0	33.3
940.196000	35.14	46.00	10.86	5000.0	120.000	139.0	V	327.0	35.2

Notes:
[1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factors = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

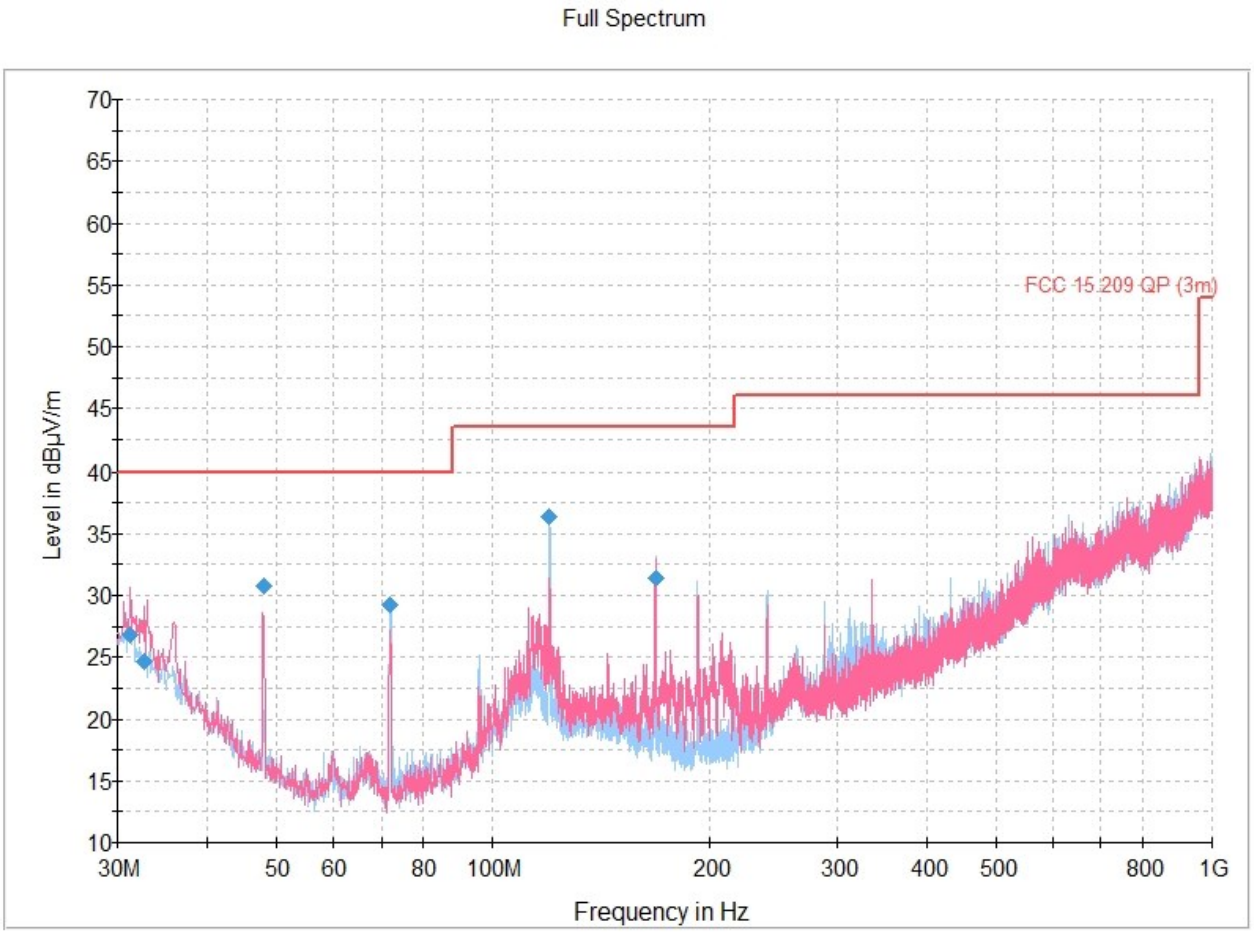

Figure 8.5-30: *Radiated emissions spectral plot (30 MHz - 1 GHz) – 2480 MHz (2Mbps, GFSK)*

Table 8.5-14*: Radiated emissions results*

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
31.261000	26.88	40.00	13.12	5000.0	120.000	151.0	V	254.0	24.5
32.727000	24.59	40.00	15.41	5000.0	120.000	129.0	V	82.0	23.6
48.048000	30.74	40.00	9.26	5000.0	120.000	104.0	V	0.0	15.2
72.018000	29.29	40.00	10.71	5000.0	120.000	229.0	H	264.0	13.2
120.016000	36.38	43.50	7.12	5000.0	120.000	296.0	H	274.0	18.4
168.231000	31.34	43.50	12.16	5000.0	120.000	143.0	H	314.0	16.9

Notes: [1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factors = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

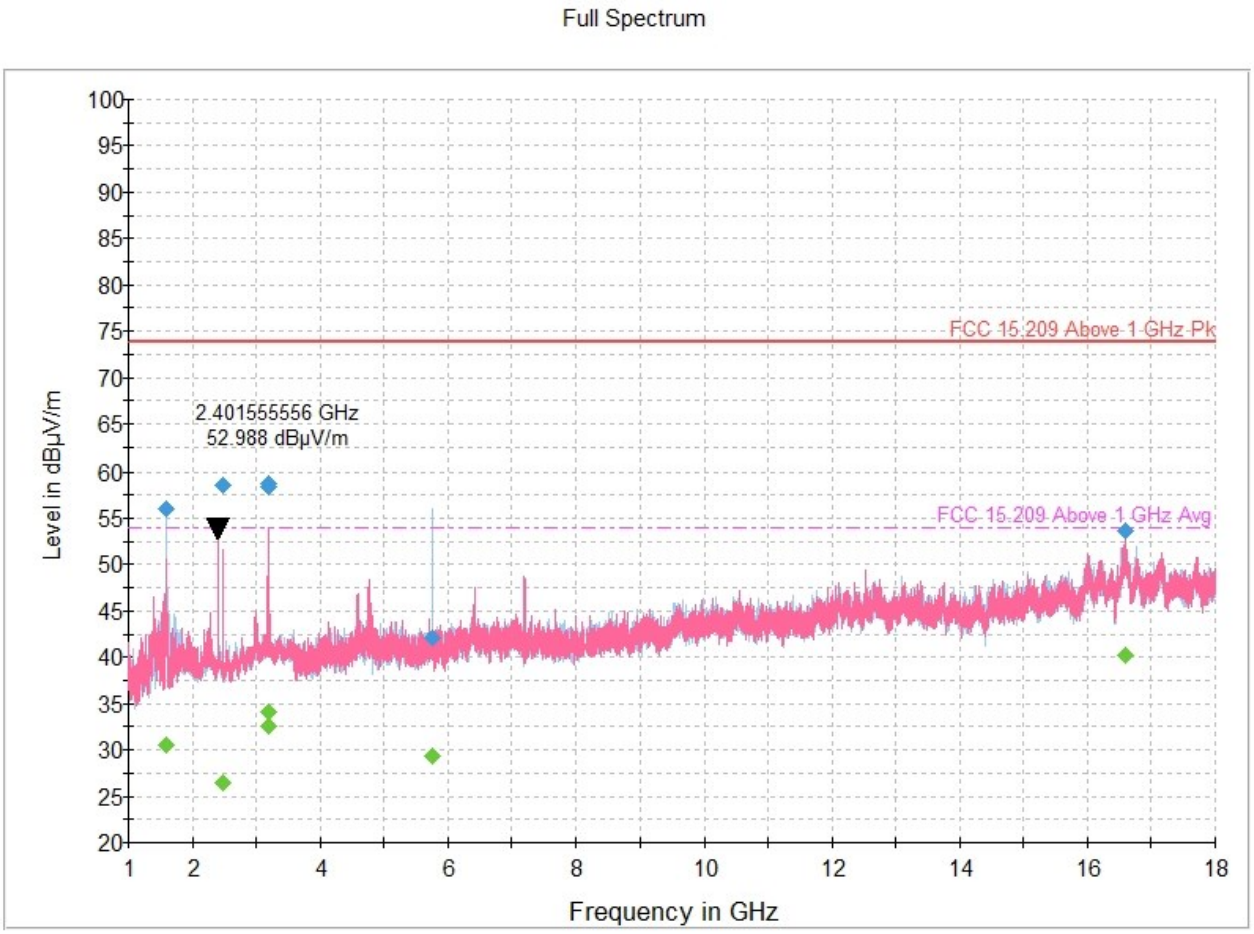

Figure 8.5-31: *Radiated emissions spectral plot (1 GHz - 18 GHz) – 2402 MHz (1Mbps, GFSK)*

Table 8.5-15*: Radiated emissions results*

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1598.377778	---	30.53	53.90	23.37	5000.0	1000.000	119.0	H	230.0	-13.5
1598.377778	55.98	---	73.90	17.92	5000.0	1000.000	119.0	H	230.0	-13.5
2479.944444	---	26.38	53.90	27.52	5000.0	1000.000	255.0	V	46.0	-8.4
2479.944444	58.58	---	73.90	15.32	5000.0	1000.000	255.0	V	46.0	-8.4
3188.711111	58.67	---	73.90	15.23	5000.0	1000.000	111.0	V	230.0	-6.2
3188.711111	---	32.62	53.90	21.28	5000.0	1000.000	111.0	V	230.0	-6.2
3194.022222	58.45	---	73.90	15.45	5000.0	1000.000	104.0	V	236.0	-6.2
3194.022222	---	34.05	53.90	19.85	5000.0	1000.000	104.0	V	236.0	-6.2
5757.922222	42.09	---	73.90	31.81	5000.0	1000.000	271.0	H	48.0	-0.5
5757.922222	---	29.31	53.90	24.59	5000.0	1000.000	271.0	H	48.0	-0.5
16597.677778	53.68	---	73.90	20.22	5000.0	1000.000	371.0	V	10.0	17.4
16597.677778	---	40.21	53.90	13.69	5000.0	1000.000	371.0	V	10.0	17.4

Notes: [1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factors = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

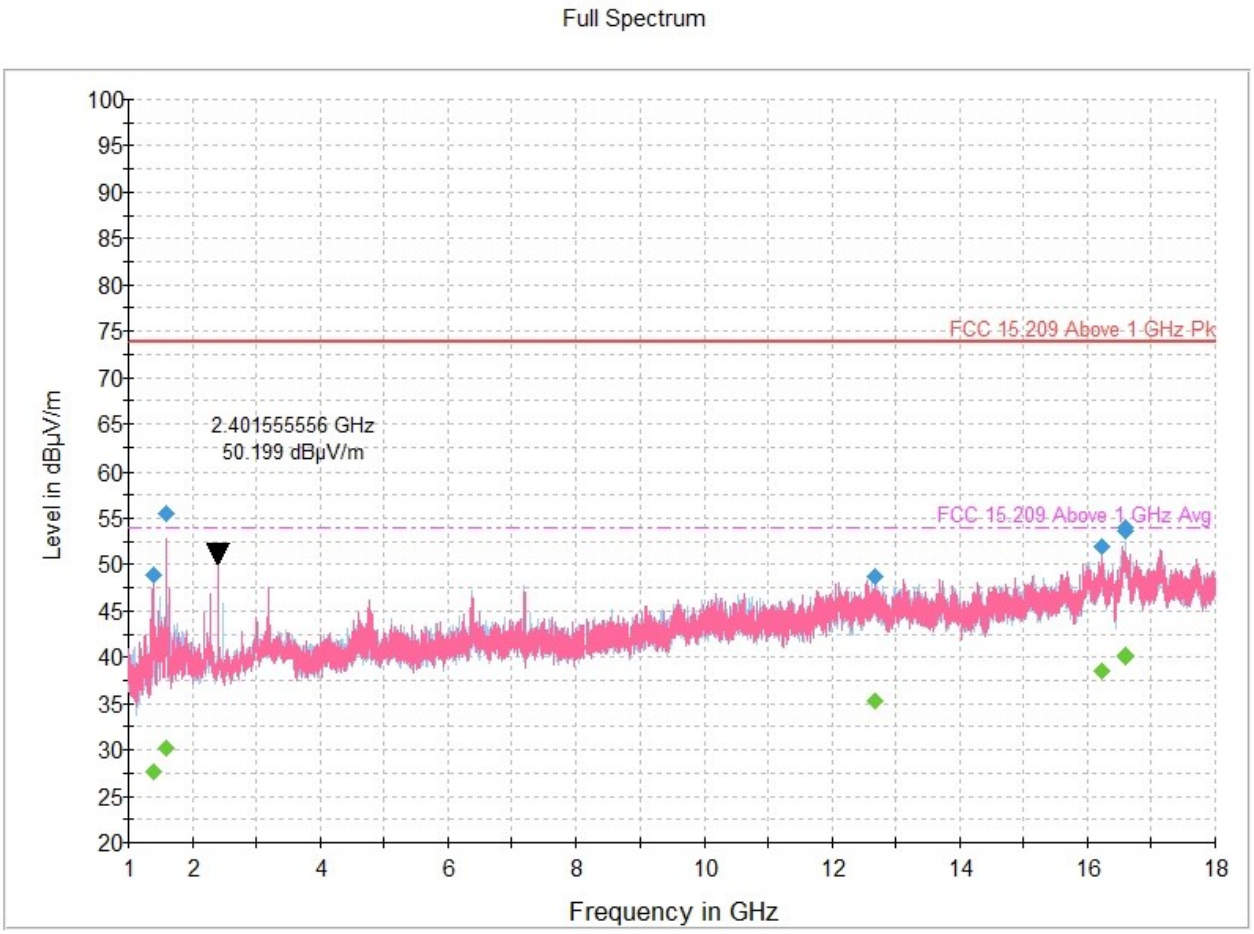

Figure 8.5-32: *Radiated emissions spectral plot (1 GHz - 18 GHz) – 2402 MHz (2Mbps, GFSK)*

Table 8.5-16*: Radiated emissions results*

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1396.711111	---	27.62	53.90	26.28	5000.0	1000.000	127.0	V	296.0	-13.9
1396.711111	48.89	---	73.90	25.01	5000.0	1000.000	127.0	V	296.0	-13.9
1596.711111	---	30.11	53.90	23.79	5000.0	1000.000	182.0	V	300.0	-13.5
1596.711111	55.50	---	73.90	18.40	5000.0	1000.000	182.0	V	300.0	-13.5
12667.744444	---	35.20	53.90	18.70	5000.0	1000.000	355.0	V	192.0	9.2
12667.744444	48.73	---	73.90	25.17	5000.0	1000.000	355.0	V	192.0	9.2
16216.377778	52.01	---	73.90	21.89	5000.0	1000.000	192.0	V	256.0	15.2
16216.377778	---	38.51	53.90	15.39	5000.0	1000.000	192.0	V	256.0	15.2
16590.266667	53.91	---	73.90	19.99	5000.0	1000.000	192.0	H	162.0	17.3
16590.266667	---	40.09	53.90	13.81	5000.0	1000.000	192.0	H	162.0	17.3
16597.466667	---	40.22	53.90	13.68	5000.0	1000.000	363.0	H	33.0	17.4
16597.466667	53.69	---	73.90	20.21	5000.0	1000.000	363.0	H	33.0	17.4

Notes: [1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factors = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

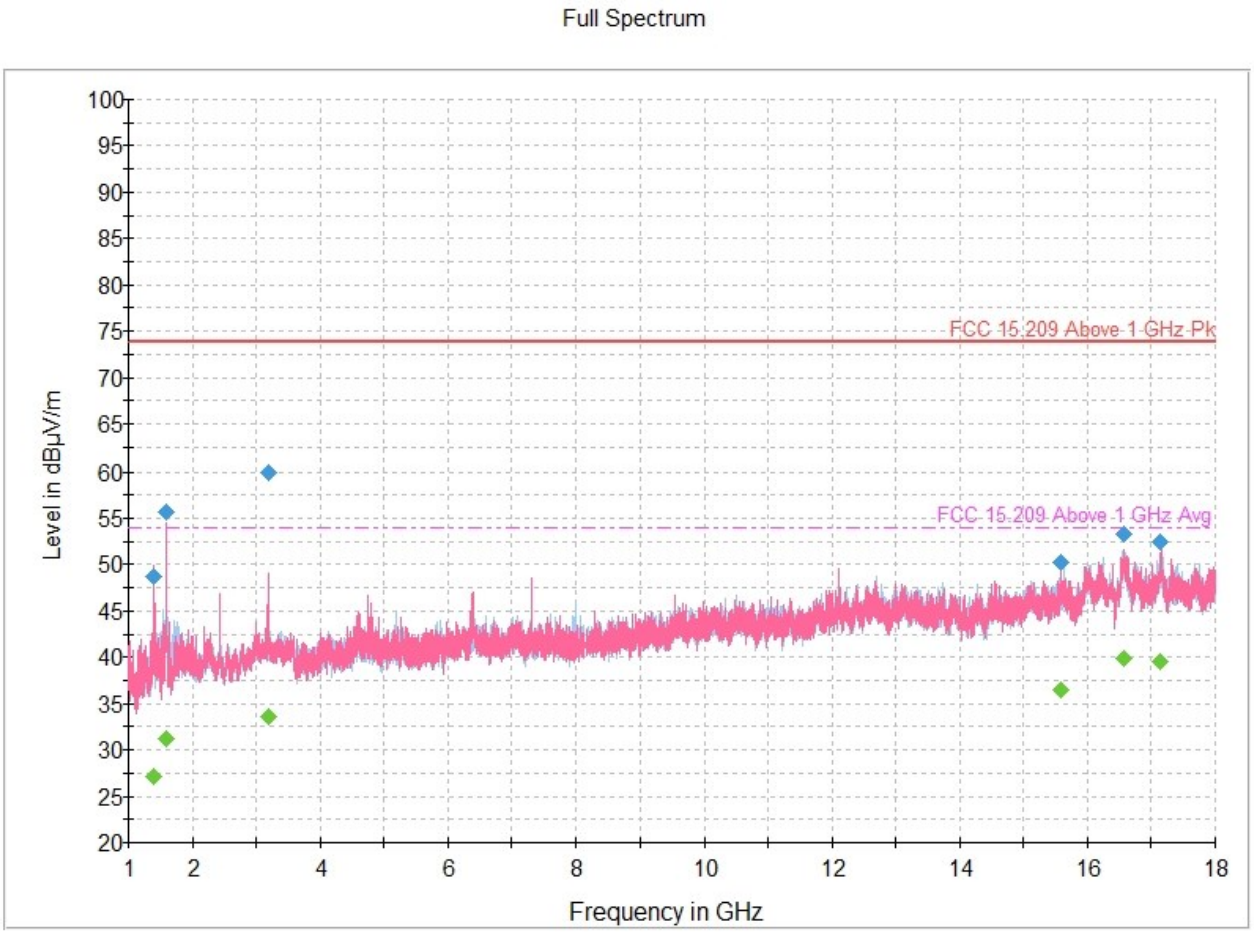

Figure 8.5-33: *Radiated emissions spectral plot (1 GHz - 18 GHz) – 2440 MHz (1Mbps, GFSK)*

Table 8.5-17*: Radiated emissions results*

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1401.577778	---	27.08	53.90	26.82	5000.0	1000.000	116.0	V	295.0	-13.9
1401.577778	48.63	---	73.90	25.27	5000.0	1000.000	116.0	V	295.0	-13.9
1597.366667	---	31.16	53.90	22.74	5000.0	1000.000	142.0	V	100.0	-13.5
1597.366667	55.70	---	73.90	18.20	5000.0	1000.000	142.0	V	100.0	-13.5
3187.477778	---	33.59	53.90	20.31	5000.0	1000.000	123.0	V	230.0	-6.2
3187.477778	59.84	---	73.90	14.06	5000.0	1000.000	123.0	V	230.0	-6.2
15576.511111	50.20	---	73.90	23.70	5000.0	1000.000	281.0	V	140.0	12.2
15576.511111	---	36.49	53.90	17.41	5000.0	1000.000	281.0	V	140.0	12.2
16573.955556	53.27	---	73.90	20.63	5000.0	1000.000	390.0	V	342.0	17.2
16573.955556	---	39.92	53.90	13.98	5000.0	1000.000	390.0	V	342.0	17.2
17146.255556	---	39.53	53.90	14.37	5000.0	1000.000	337.0	V	189.0	16.6
17146.255556	52.51	---	73.90	21.39	5000.0	1000.000	337.0	V	189.0	16.6

Notes: [1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factors = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

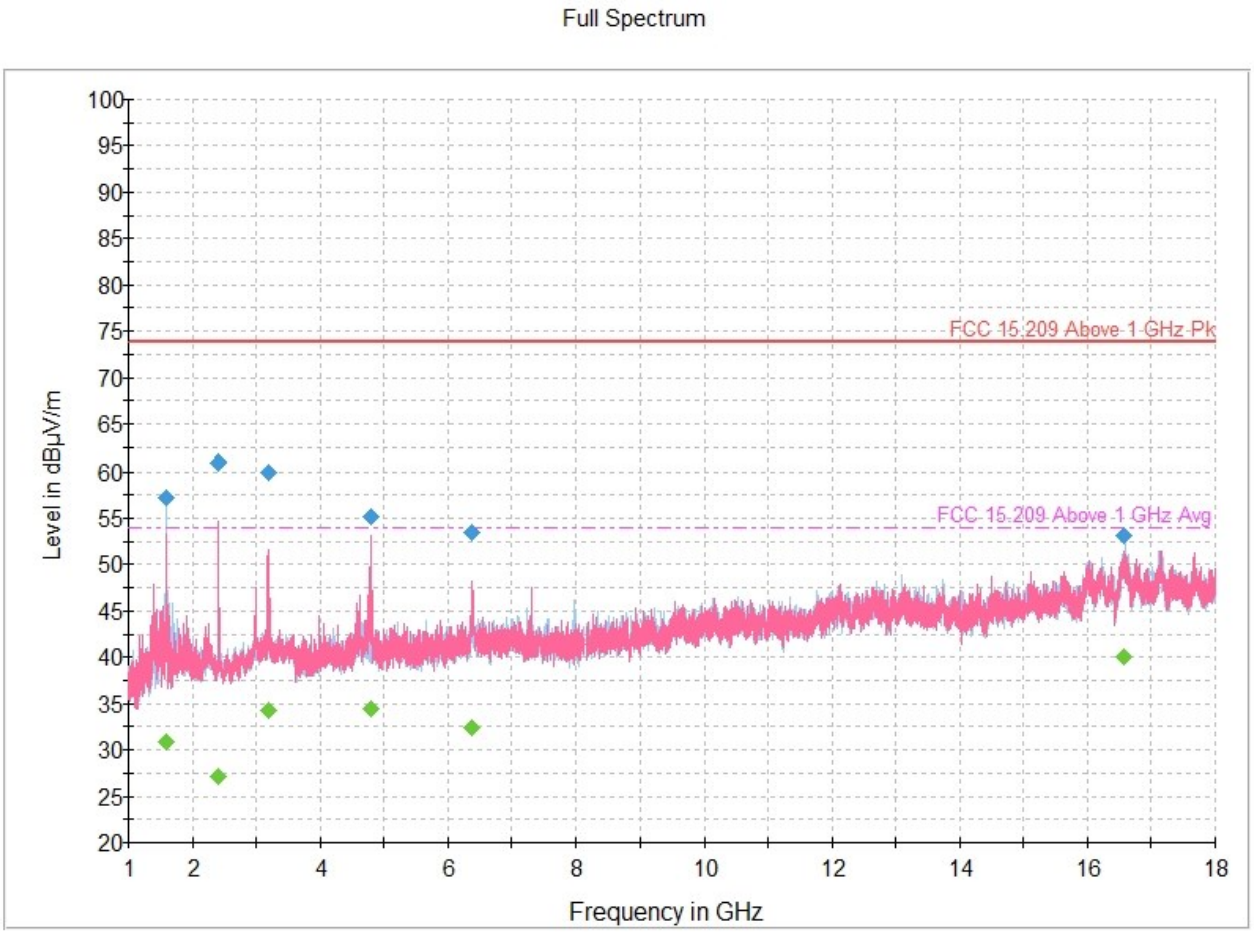

Figure 8.5-34: *Radiated emissions spectral plot (1 GHz - 18 GHz) – 2440 MHz (2Mbps, GFSK)*

Table 8.5-18*: Radiated emissions results*

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1599.144444	---	30.92	53.90	22.98	5000.0	1000.000	123.0	H	229.0	-13.5
1599.144444	57.18	---	73.90	16.72	5000.0	1000.000	123.0	H	229.0	-13.5
2401.955556	60.99	---	73.90	12.91	5000.0	1000.000	154.0	V	244.0	-8.8
2401.955556	---	27.20	53.90	26.70	5000.0	1000.000	154.0	V	244.0	-8.8
3198.011111	59.99	---	73.90	13.91	5000.0	1000.000	115.0	V	241.0	-6.2
3198.011111	---	34.27	53.90	19.63	5000.0	1000.000	115.0	V	241.0	-6.2
4787.944444	---	34.46	53.90	19.44	5000.0	1000.000	124.0	V	267.0	-1.1
4787.944444	55.19	---	73.90	18.71	5000.0	1000.000	124.0	V	267.0	-1.1
6374.944444	53.50	---	73.90	20.40	5000.0	1000.000	139.0	V	244.0	1.5
6374.944444	---	32.37	53.90	21.53	5000.0	1000.000	139.0	V	244.0	1.5
16578.022222	53.20	---	73.90	20.70	5000.0	1000.000	289.0	H	22.0	17.3
16578.022222	---	40.08	53.90	13.82	5000.0	1000.000	289.0	H	22.0	17.3

Notes: [1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factors = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

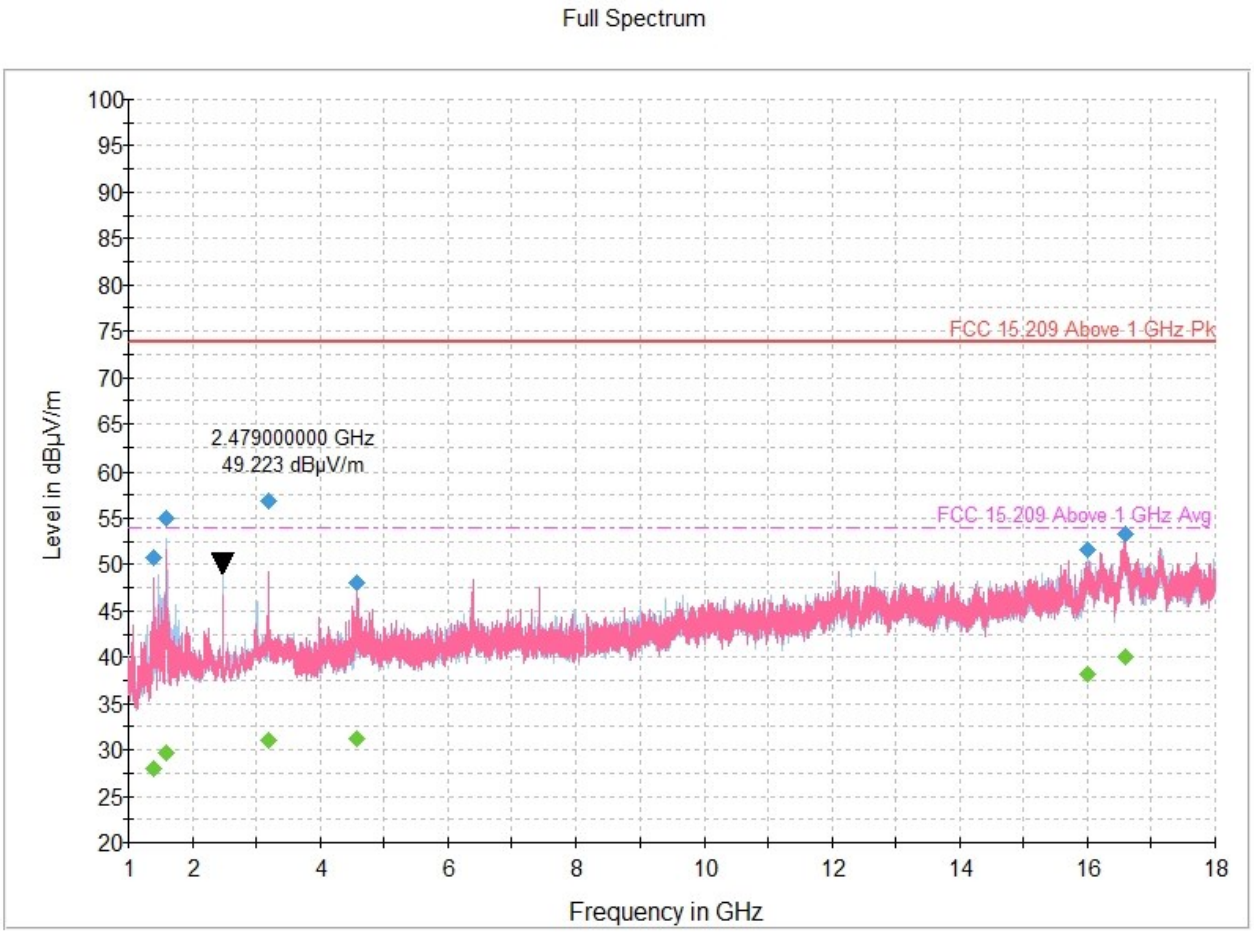

Figure 8.5-35: *Radiated emissions spectral plot (1 GHz - 18 GHz) – 2480 MHz (1Mbps, GFSK)*

Table 8.5-19*: Radiated emissions results*

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1392.200000	50.68	---	73.90	23.22	5000.0	1000.000	170.0	V	300.0	-13.8
1392.200000	---	28.03	53.90	25.87	5000.0	1000.000	170.0	V	300.0	-13.8
1594.855556	54.92	---	73.90	18.98	5000.0	1000.000	104.0	H	222.0	-13.5
1594.855556	---	29.73	53.90	24.17	5000.0	1000.000	104.0	H	222.0	-13.5
3192.955556	---	31.00	53.90	22.90	5000.0	1000.000	191.0	V	231.0	-6.2
3192.955556	56.85	---	73.90	17.05	5000.0	1000.000	191.0	V	231.0	-6.2
4586.344444	48.06	---	73.90	25.84	5000.0	1000.000	108.0	V	86.0	-0.9
4586.344444	---	31.17	53.90	22.73	5000.0	1000.000	108.0	V	86.0	-0.9
16001.333333	51.57	---	73.90	22.33	5000.0	1000.000	247.0	H	324.0	14.2
16001.333333	---	38.25	53.90	15.65	5000.0	1000.000	247.0	H	324.0	14.2
16585.444444	---	40.10	53.90	13.80	5000.0	1000.000	225.0	V	36.0	17.3
16585.444444	53.22	---	73.90	20.68	5000.0	1000.000	225.0	V	36.0	17.3

Notes: [1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factors = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

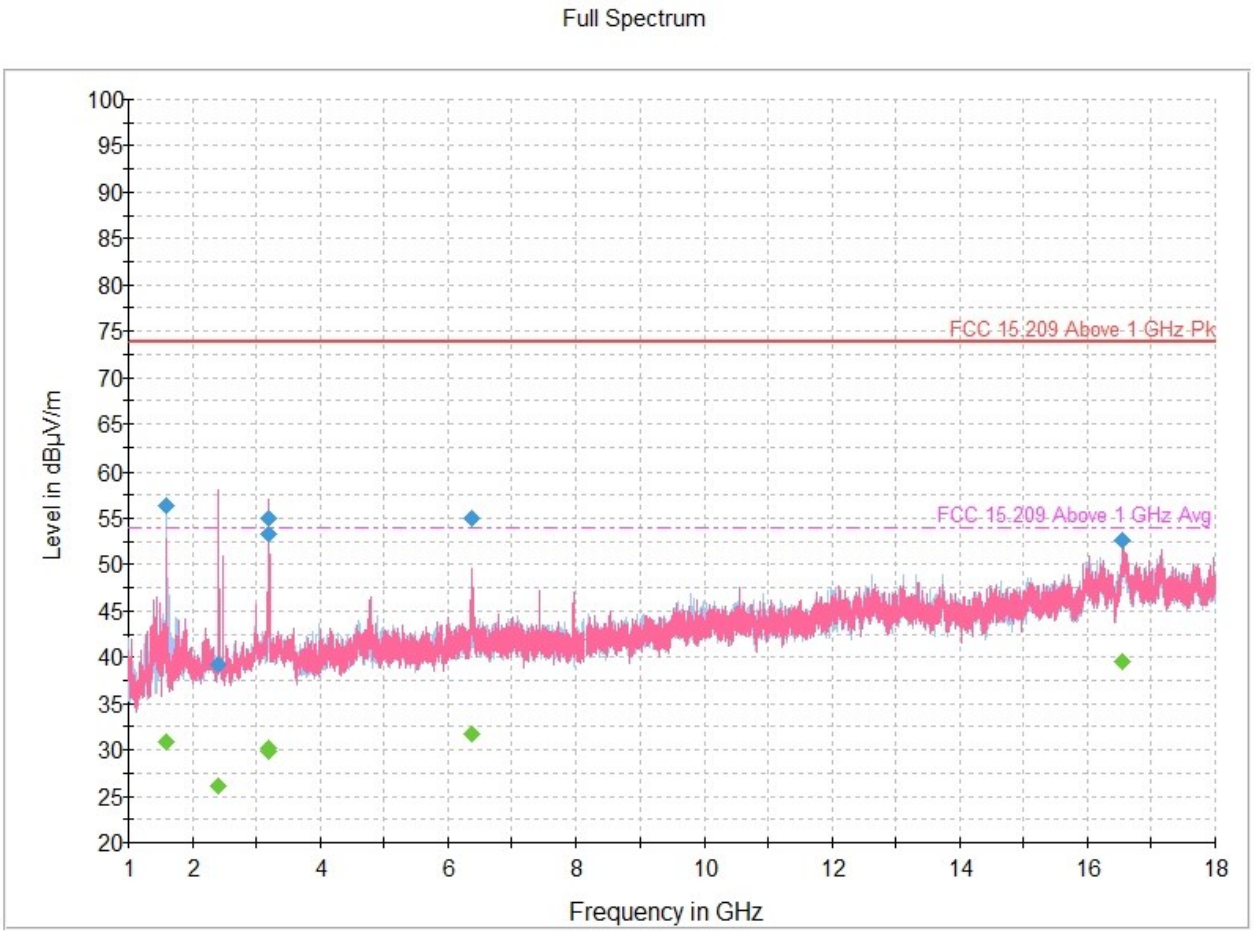

Figure 8.5-36: *Radiated emissions spectral plot (1 GHz - 18 GHz) – 2480 MHz (2Mbps, GFSK)*

Table 8.5-20*: Radiated emissions results*

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1595.977778	---	30.81	53.90	23.09	5000.0	1000.000	120.0	H	230.0	-13.5
1595.977778	56.33	---	73.90	17.57	5000.0	1000.000	120.0	H	230.0	-13.5
2412.600000	---	26.14	53.90	27.76	5000.0	1000.000	308.0	V	306.0	-8.7
2412.600000	39.17	---	73.90	34.73	5000.0	1000.000	308.0	V	306.0	-8.7
3198.266667	55.05	---	73.90	18.85	5000.0	1000.000	174.0	V	222.0	-6.2
3198.266667	---	29.89	53.90	24.01	5000.0	1000.000	174.0	V	222.0	-6.2
3201.133333	---	30.22	53.90	23.68	5000.0	1000.000	201.0	V	237.0	-6.2
3201.133333	53.22	---	73.90	20.68	5000.0	1000.000	201.0	V	237.0	-6.2
6374.655556	54.92	---	73.90	18.98	5000.0	1000.000	112.0	V	215.0	1.5
6374.655556	---	31.80	53.90	22.10	5000.0	1000.000	112.0	V	215.0	1.5
16544.244444	---	39.60	53.90	14.30	5000.0	1000.000	112.0	V	111.0	16.8
16544.244444	52.55	---	73.90	21.35	5000.0	1000.000	112.0	V	111.0	16.8

Notes: [1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factors = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

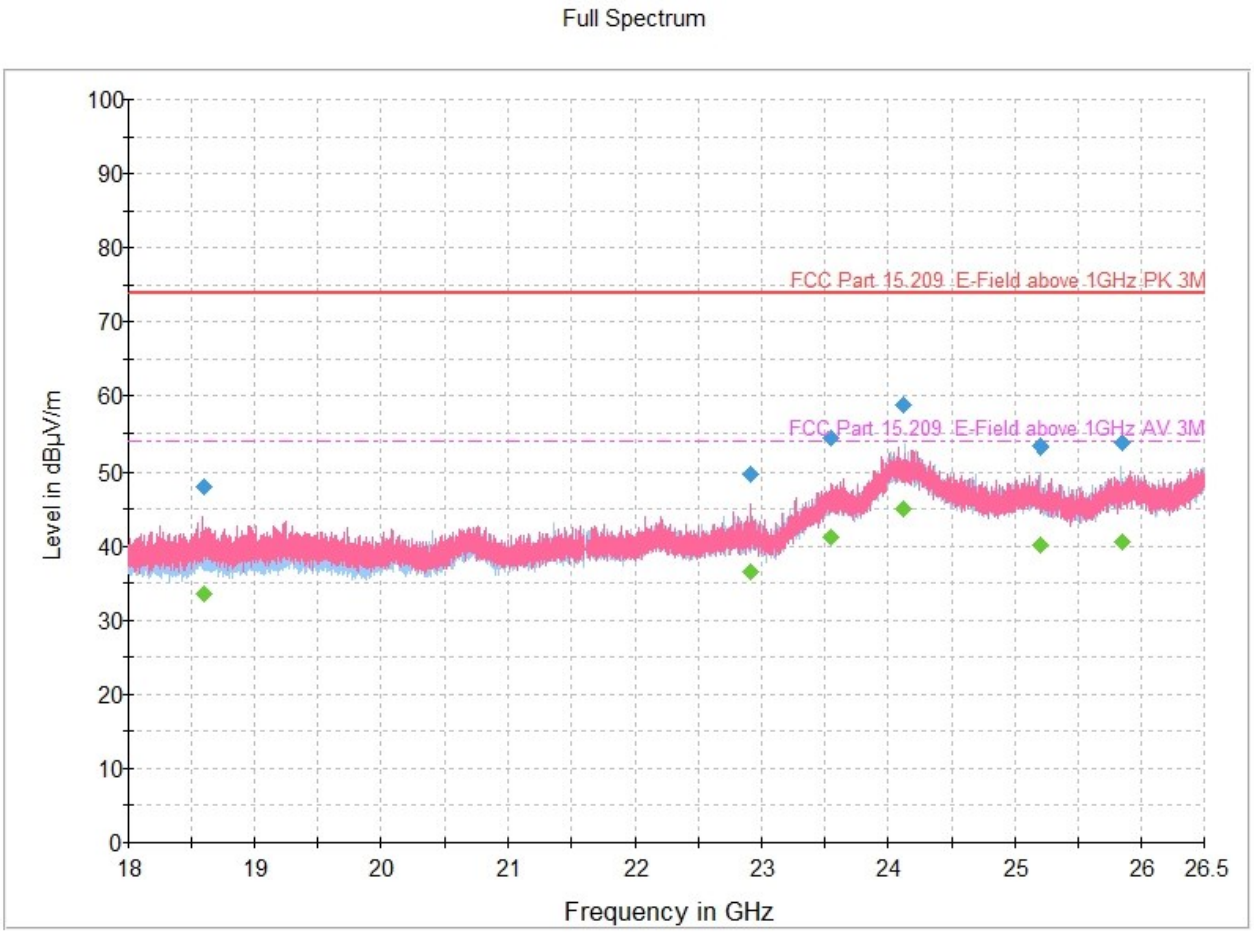

Figure 8.5-37: *Radiated emissions spectral plot (18 GHz - 26.5 GHz) – 2402 MHz (1Mbps, GFSK)*

Table 8.5-21*: Radiated emissions results*

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
18598.481250	---	33.61	53.90	20.29	5000.0	1000.000	179.0	V	11.0	16.1
18598.481250	48.03	---	73.90	25.87	5000.0	1000.000	179.0	V	11.0	16.1
22908.081250	49.78	---	73.90	24.12	5000.0	1000.000	155.0	V	0.0	19.0
22908.081250	---	36.44	53.90	17.46	5000.0	1000.000	155.0	V	0.0	19.0
23544.793750	---	41.11	53.90	12.79	5000.0	1000.000	400.0	V	172.0	23.6
23544.793750	54.39	---	73.90	19.51	5000.0	1000.000	400.0	V	172.0	23.6
24122.962500	58.77	---	73.90	15.13	5000.0	1000.000	143.0	H	42.0	27.3
24122.962500	---	45.01	53.90	8.89	5000.0	1000.000	143.0	H	42.0	27.3
25200.468750	53.35	---	73.90	20.55	5000.0	1000.000	278.0	H	299.0	21.5
25200.468750	---	40.16	53.90	13.74	5000.0	1000.000	278.0	H	299.0	21.5
25852.581250	53.75	---	73.90	20.15	5000.0	1000.000	191.0	H	98.0	21.4
25852.581250	---	40.45	53.90	13.45	5000.0	1000.000	191.0	H	98.0	21.4

Notes: [1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factors = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

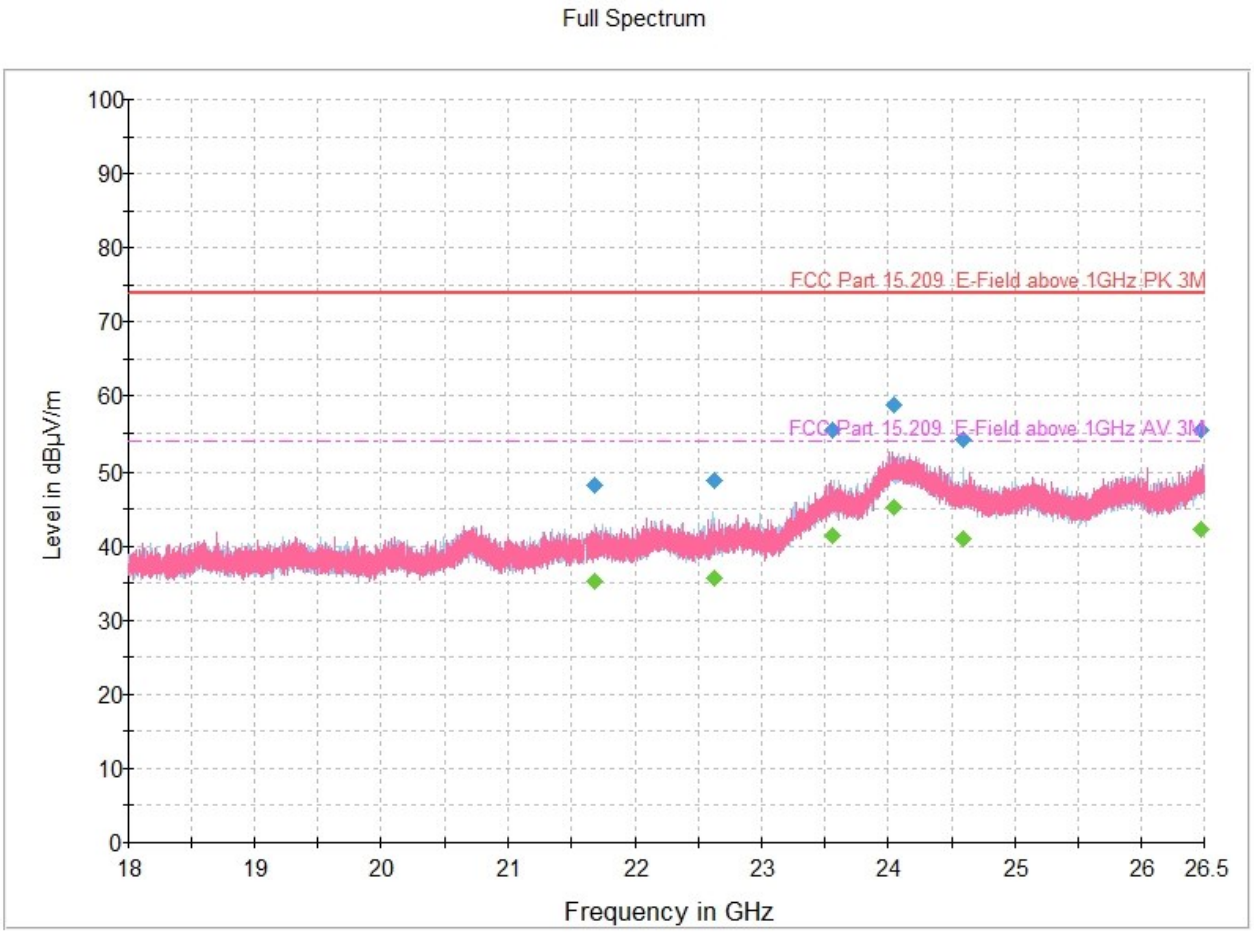

Figure 8.5-38: *Radiated emissions spectral plot (18 GHz - 26.5 GHz) – 2402 MHz (2Mbps, GFSK)*

Table 8.5-22*: Radiated emissions results*

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
21681.168750	---	35.18	53.90	18.72	5000.0	1000.000	400.0	H	186.0	17.3
21681.168750	48.11	---	73.90	25.79	5000.0	1000.000	400.0	H	186.0	17.3
22624.825000	---	35.64	53.90	18.26	5000.0	1000.000	207.0	H	156.0	18.1
22624.825000	48.88	---	73.90	25.02	5000.0	1000.000	207.0	H	156.0	18.1
23552.875000	55.37	---	73.90	18.53	5000.0	1000.000	104.0	V	295.0	23.7
23552.875000	---	41.36	53.90	12.54	5000.0	1000.000	104.0	V	295.0	23.7
24043.306250	---	45.28	53.90	8.62	5000.0	1000.000	235.0	V	257.0	27.6
24043.306250	58.79	---	73.90	15.11	5000.0	1000.000	235.0	V	257.0	27.6
24597.106250	---	40.97	53.90	12.93	5000.0	1000.000	214.0	H	44.0	22.7
24597.106250	54.07	---	73.90	19.83	5000.0	1000.000	214.0	H	44.0	22.7
26478.925000	55.44	---	73.90	18.46	5000.0	1000.000	362.0	V	77.0	23.3
26478.925000	---	42.34	53.90	11.56	5000.0	1000.000	362.0	V	77.0	23.3

Notes: [1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factors = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

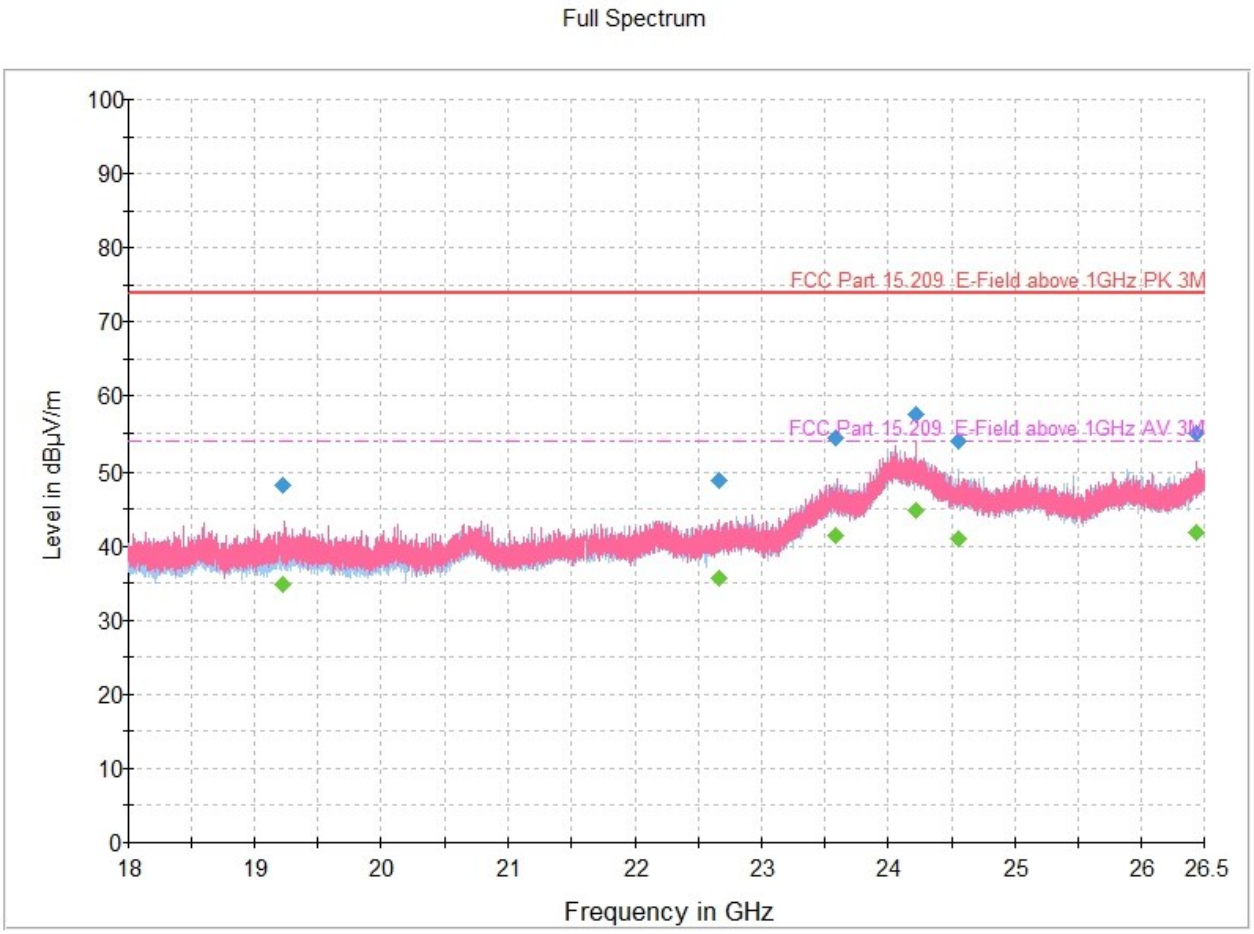

Figure 8.5-39: *Radiated emissions spectral plot (18 GHz - 26.5 GHz) – 2440 MHz (1Mbps, GFSK)*

Table 8.5-23*: Radiated emissions results*

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
19219.831250	48.13	---	73.90	25.77	5000.0	1000.000	115.0	V	191.0	16.4
19219.831250	---	34.83	53.90	19.07	5000.0	1000.000	115.0	V	191.0	16.4
22655.468750	---	35.73	53.90	18.17	5000.0	1000.000	220.0	V	0.0	18.2
22655.468750	48.87	---	73.90	25.03	5000.0	1000.000	220.0	V	0.0	18.2
23581.075000	54.45	---	73.90	19.45	5000.0	1000.000	388.0	H	118.0	23.9
23581.075000	---	41.36	53.90	12.54	5000.0	1000.000	388.0	H	118.0	23.9
24223.731250	---	44.74	53.90	9.16	5000.0	1000.000	357.0	V	0.0	27.0
24223.731250	57.60	---	73.90	16.30	5000.0	1000.000	357.0	V	0.0	27.0
24551.631250	---	40.99	53.90	12.91	5000.0	1000.000	273.0	H	284.0	22.8
24551.631250	53.91	---	73.90	19.99	5000.0	1000.000	273.0	H	284.0	22.8
26438.625000	---	41.93	53.90	11.97	5000.0	1000.000	301.0	V	0.0	23.1
26438.625000	54.96	---	73.90	18.94	5000.0	1000.000	301.0	V	0.0	23.1

Notes: [1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factors = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

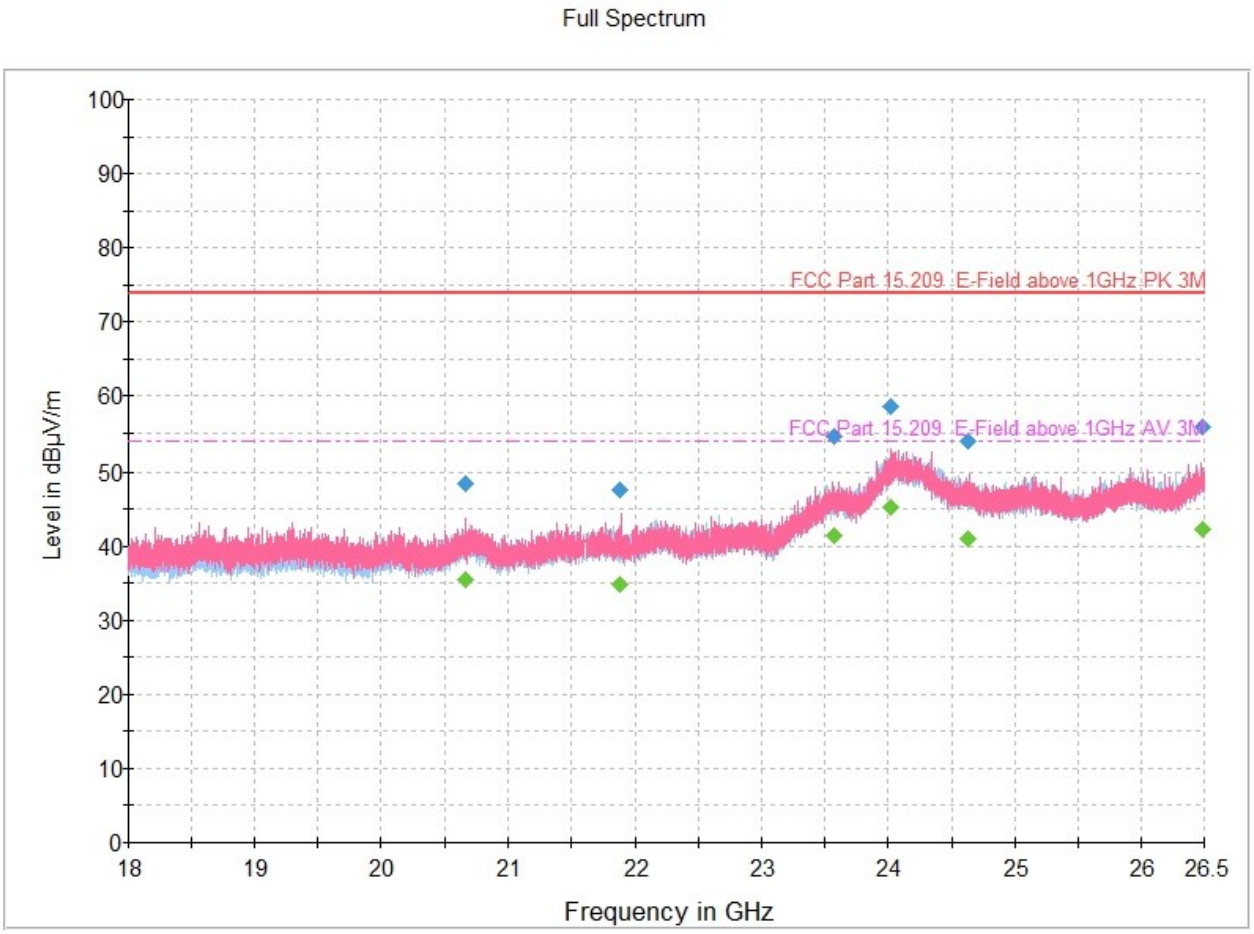

Figure 8.5-40: *Radiated emissions spectral plot (18 GHz - 26.5 GHz) – 2440 MHz (2Mbps, GFSK)*

Table 8.5-24*: Radiated emissions results*

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
20667.200000	48.37	---	73.90	25.53	5000.0	1000.000	148.0	V	207.0	18.0
20667.200000	---	35.41	53.90	18.49	5000.0	1000.000	148.0	V	207.0	18.0
21879.375000	---	34.79	53.90	19.11	5000.0	1000.000	237.0	V	334.0	17.2
21879.375000	47.60	---	73.90	26.30	5000.0	1000.000	237.0	V	334.0	17.2
23568.968750	54.60	---	73.90	19.30	5000.0	1000.000	280.0	V	98.0	23.9
23568.968750	---	41.34	53.90	12.56	5000.0	1000.000	280.0	V	98.0	23.9
24018.443750	---	45.20	53.90	8.70	5000.0	1000.000	265.0	V	314.0	27.5
24018.443750	58.55	---	73.90	15.35	5000.0	1000.000	265.0	V	314.0	27.5
24624.606250	---	40.95	53.90	12.95	5000.0	1000.000	186.0	V	99.0	22.6
24624.606250	53.87	---	73.90	20.03	5000.0	1000.000	186.0	V	99.0	22.6
26492.587500	---	42.32	53.90	11.58	5000.0	1000.000	294.0	V	134.0	23.4
26492.587500	55.92	---	73.90	17.98	5000.0	1000.000	294.0	V	134.0	23.4

Notes: [1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factors = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

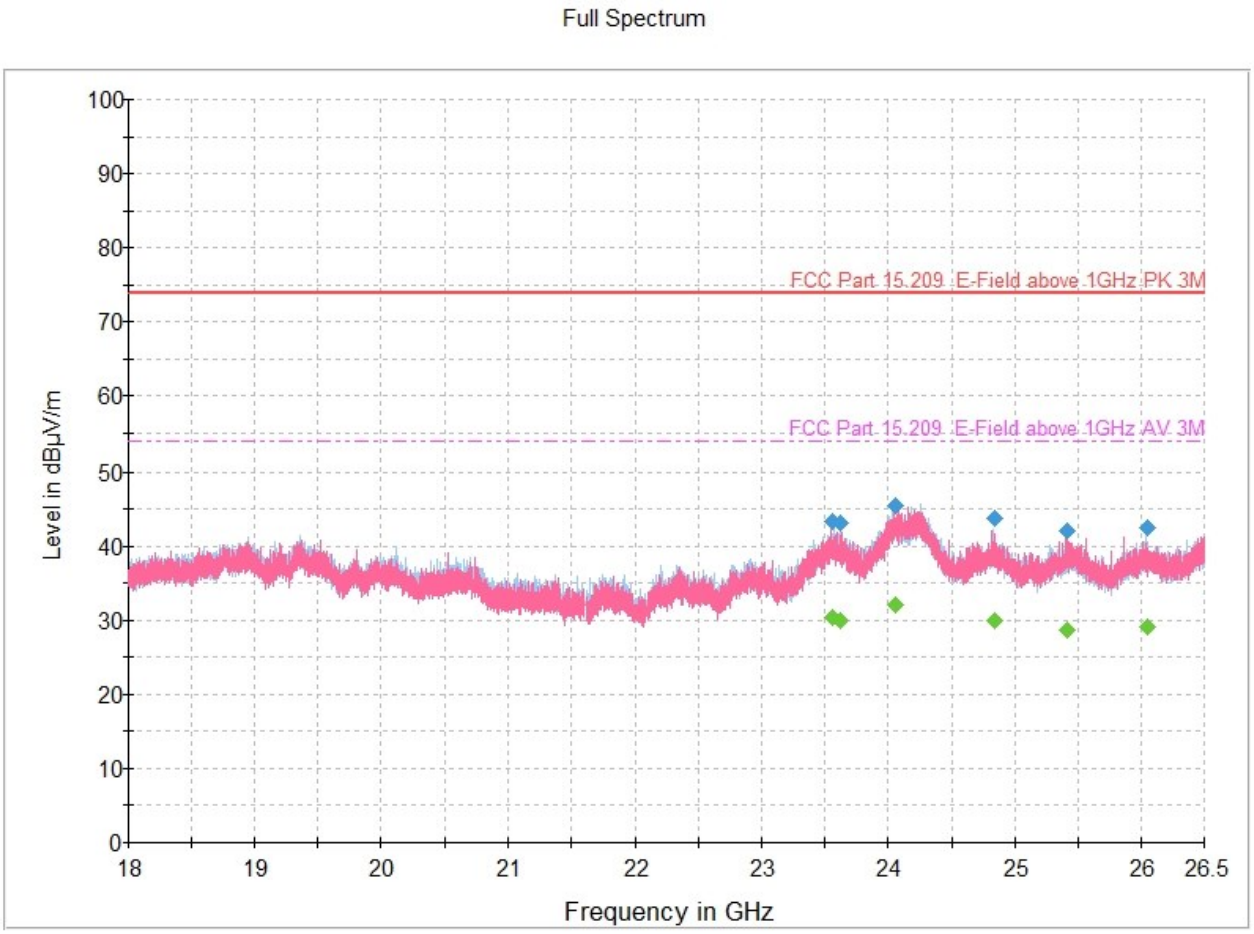

Figure 8.5-41: *Radiated emissions spectral plot (18 GHz - 26.5 GHz) – 2480 MHz (1Mbps, GFSK)*

Table 8.5-25*: Radiated emissions results*

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
23555.437500	43.27	---	73.90	30.63	5000.0	1000.000	291.0	V	248.0	23.7
23555.437500	---	30.27	53.90	23.63	5000.0	1000.000	291.0	V	248.0	23.7
23625.912500	43.12	---	73.90	30.78	5000.0	1000.000	222.0	H	178.0	23.7
23625.912500	---	29.95	53.90	23.95	5000.0	1000.000	222.0	H	178.0	23.7
24057.850000	---	32.13	53.90	21.77	5000.0	1000.000	400.0	H	207.0	27.5
24057.850000	45.41	---	73.90	28.49	5000.0	1000.000	400.0	H	207.0	27.5
24838.312500	---	29.95	53.90	23.95	5000.0	1000.000	299.0	H	11.0	22.3
24838.312500	43.81	---	73.90	30.09	5000.0	1000.000	299.0	H	11.0	22.3
25419.475000	42.00	---	73.90	31.90	5000.0	1000.000	268.0	V	229.0	21.6
25419.475000	---	28.74	53.90	25.16	5000.0	1000.000	268.0	V	229.0	21.6
26045.425000	42.54	---	73.90	31.36	5000.0	1000.000	268.0	H	0.0	21.9
26045.425000	---	29.08	53.90	24.82	5000.0	1000.000	268.0	H	0.0	21.9

Notes: [1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factors = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

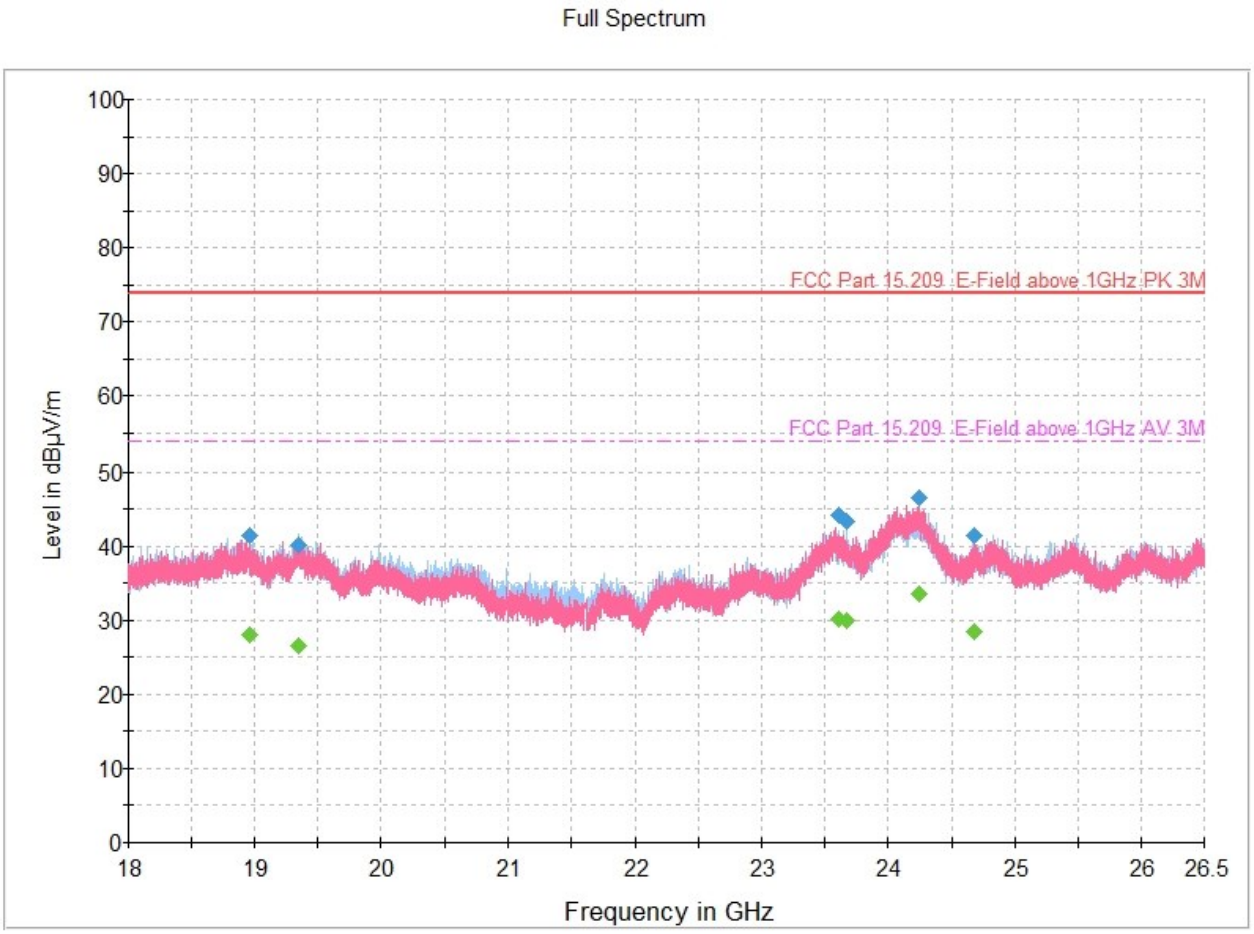

Figure 8.5-42: *Radiated emissions spectral plot (18 GHz - 26.5 GHz) – 2480 MHz (2Mbps, GFSK)*

Table 8.5-26*: Radiated emissions results*

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
18959.893750	41.31	---	73.90	32.59	5000.0	1000.000	325.0	V	321.0	15.9
18959.893750	---	27.99	53.90	25.91	5000.0	1000.000	325.0	V	321.0	15.9
19349.368750	40.12	---	73.90	33.78	5000.0	1000.000	145.0	H	358.0	16.7
19349.368750	---	26.56	53.90	27.34	5000.0	1000.000	145.0	H	358.0	16.7
23602.350000	44.14	---	73.90	29.76	5000.0	1000.000	278.0	V	151.0	23.8
23602.350000	---	30.14	53.90	23.76	5000.0	1000.000	278.0	V	151.0	23.8
23664.725000	43.27	---	73.90	30.63	5000.0	1000.000	261.0	H	320.0	23.5
23664.725000	---	30.00	53.90	23.90	5000.0	1000.000	261.0	H	320.0	23.5
24248.837500	---	33.48	53.90	20.42	5000.0	1000.000	333.0	H	0.0	26.9
24248.837500	46.47	---	73.90	27.43	5000.0	1000.000	333.0	H	0.0	26.9
24682.756250	---	28.44	53.90	25.46	5000.0	1000.000	306.0	V	299.0	22.4
24682.756250	41.50	---	73.90	32.40	5000.0	1000.000	306.0	V	299.0	22.4

Notes: [1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factors = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

8.6 Power spectral density

8.6.1 References and limits

- FCC 47 CFR Part 15, Subpart C: §15.247(e)
- Test method: ANSI C63.10-2020 §11.10.2.1 (Method PKPSD)

§15.247:

(e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

8.6.2 Test summary

Verdict	Pass		
Test date	September 30, 2024	Temperature	20 °C
Test engineer	Lan Sayasane, EMC Test Engineer	Air pressure	1003.0 mbar
Test location	☒ Wireless bench ☐ Other:	Relative humidity	64 %

8.6.3 Notes

Testing was performed with the transmitter operating on a fixed channel (lowest, middle, and highest) at maximum output power.

The spectral plots within this section have been corrected with all relevant transducer factors.

8.6.4 Setup details

EUT power input during test	Battery
EUT setup configuration	☒ Table-top ☐ Floor standing ☐ Other:

Spectrum analyzer settings:

Resolution bandwidth	3 kHz
Video bandwidth	10 kHz
Detector mode	Peak
Trace mode	Max Hold
Measurement time	Long enough for trace to stabilize

8.6.5 Test data

Table 8.6-1: *Power spectral density test data*

Test Frequency (MHz)	Modulation	Power Density (dBm/3 kHz)	Limit (dBm)
2402	GFSK, 1 Mbps	-22.04	≤ 8
2440	GFSK, 1 Mbps	-22.41	≤ 8
2480	GFSK, 1 Mbps	-24.77	≤ 8
2402	GFSK, 2 Mbps	-24.31	≤ 8
2440	GFSK, 2 Mbps	-25.01	≤ 8
2480	GFSK, 2 Mbps	-27.27	≤ 8

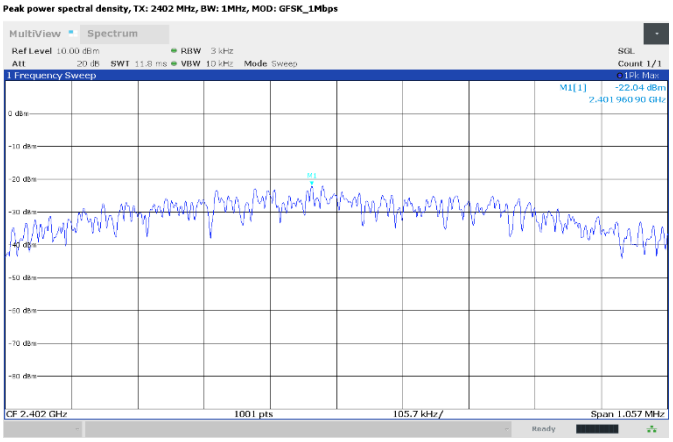

Figure 8.6-1: *Power spectral density, GFSK, 1 Mbps, 2402 MHz*

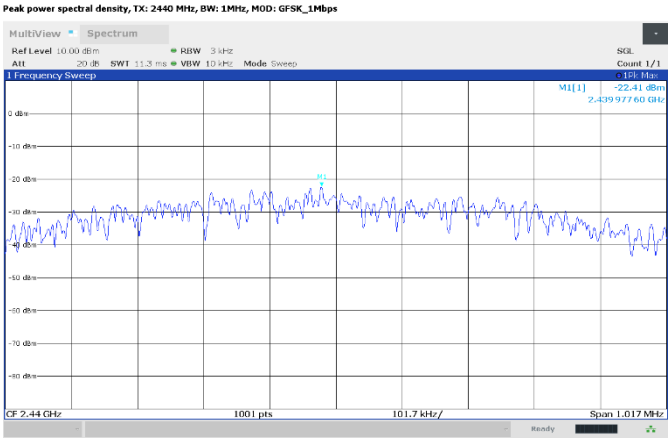

Figure 8.6-2: *Power spectral density, GFSK, 1 Mbps, 2440 MHz*

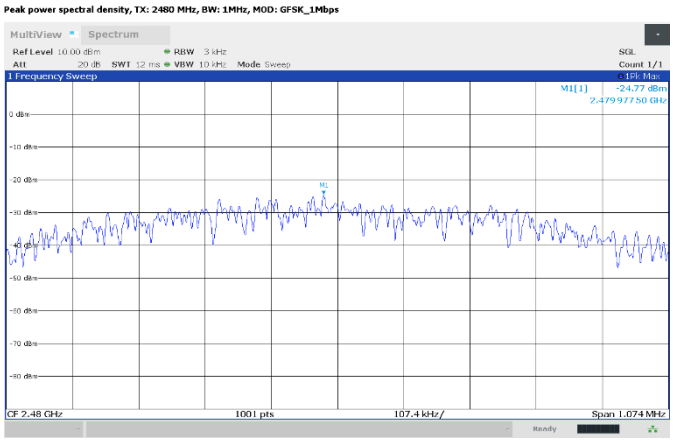

Figure 8.6-3: *Power spectral density, GFSK, 1 Mbps, 2480 MHz*

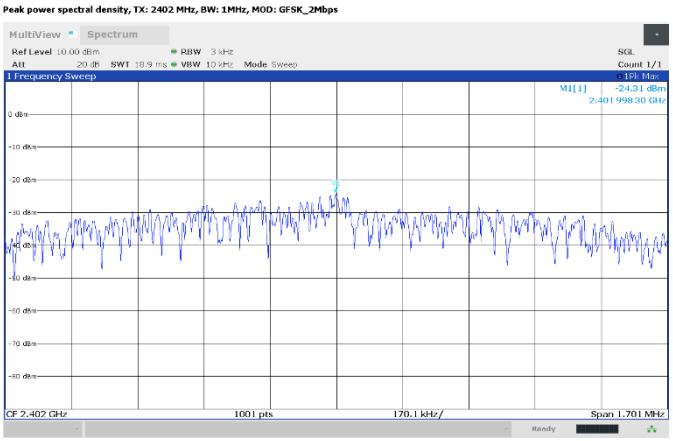

Figure 8.6-4: *Power spectral density, GFSK, 2 Mbps, 2402 MHz*

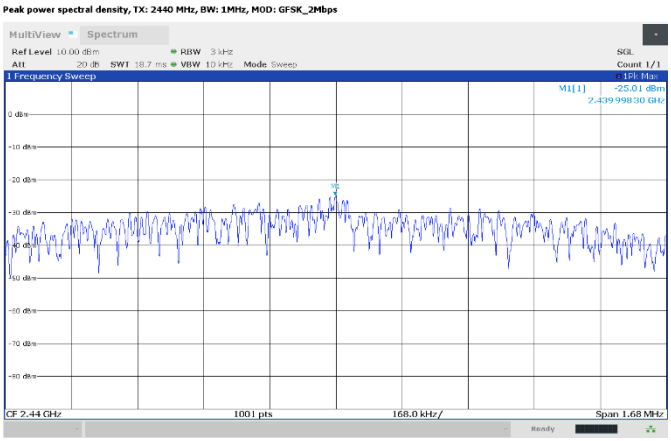

Figure 8.6-5: *Power spectral density, GFSK, 2 Mbps, 2440 MHz*

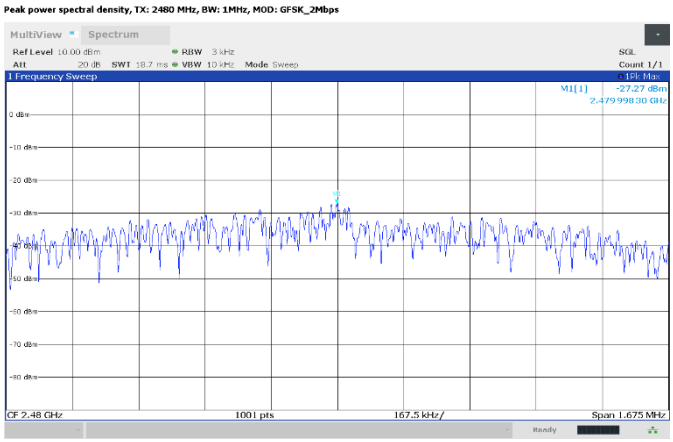

Figure 8.6-6: *Power spectral density, GFSK, 2 Mbps, 2480 MHz*

End of test report